For People Interested in the Enrichment of Personal Computing

November, 1982 $3.50 in U.S.A.

99'er magazine™

Covering the TI-99/4A
and other Texas Instruments
Personal Computer Systems

Introducing:

PORTABLE MAGAZINE COMPUTING™

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PASCAL
ASMBLY
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HAYDER

Home Computer Languages

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PHA	1950	Thermal Paper (2 Pack)	7.50
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APPLICATION PROGRAMS

Home Management Personal Finance

Command Modules

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PHM	3016	Tax Investment Record Keeping (Disk system is required)	53.95
PHM	3022	Personal Real Estate (Data storage system is recommended)	53.95
PHM	3044	Personal Report Generator (Data storage system is recommended and PHM 3113 is recommended)	38.95
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Diskette

PHD	5001	Mailing List	53.95
PHD	5003	Personal Financial Aids	15.95
PHD	5021	Checkbook Manager	15.95
PHD	5077	Personal Tax Plan (Aardvark Software Inc.) (P-Code and 32K Memory Expansion are required. RS232 and Printer are recommended)	74.95

Cassette

PHT	6003	Personal Financial Aids	11.95
PHT	6038	Business Aids Library — Lease Purchase Decisions (Printer is recommended)	46.95

Education Personal Enrichment

Command Modules

Texas Instruments Packages

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PHM	3003	Beginning Grammer	22.95
PHM	3004	Number Magic	15.95
PHM	3005	Video Graphs	15.95
PHM	3008	Video Chess	53.95
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PHM	3020	Music Maker (Data Storage System is recommended)	30.95
PHM	3021	Weight Control and Nutrition (Data Storage System is recommended)	46.95
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PHM	3109	TI Logo II (32K Memory Expansion is required)	69.95
PHM	3015	Early Reading (Solid State Speech Synthesizer is required)	41.95
PHM	3043	Reading Fun (Solid State Speech™ Synthesizer is recommended)	41.95
PHM	3046	Reading On	41.95
PHM	3047	Reading Roundup	41.95
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PHM	3082	Reading Flight	41.95
PHM	3027	Addition and Subtraction I (Solid State Speech™ Synthesizer is recommended)	30.95
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Gabriel Industries Packages (Developed by Gabriel Industries)

PHM	3067	Othello (Developed by Gabriel Industries)	30.95

Diskette

Texas Instruments Packages

PHD	5002	TI-Trek (with optional speech)	10.95
PHD	5010	Mystery Melody	10.95
PHD	5015	Oldies But Goodies — Games I	15.95
PHD	5017	Oldies But Goodies — Games II	19.95
PHD	5025	Saturday Night Bingo (Solid State Speech™ Synthesizer is required)	22.95
PHD	5037	Draw Poker (Extended BASIC Command Module required)	19.95
PHD	5057	Tombstone City 21st Century (32K Memory Expansion and Extended BASIC Command Module are required)	15.95
PHD	5058	TI Invaders (32K Memory Expansion and Either Extended BASIC or Editor Assembler Command Module are required)	15.95
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PHD	5050	Strange Odyssey	22.95
PHD	5051	Mystery Fun House	22.95
PHD	5052	Pyramid of Doom	22.95
PHD	5053	Ghost Town	22.95
PHD	5054	Savage Island I & II	30.95
PHD	5056	Golden Voyage	22.95

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Texas Instruments Packages

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PHT	6017	Oldies But Goodies — Games II	15.95
PHT	6025	Saturday Night Bingo (Solid State Speech™ Synthesizer is required)	19.95
PHT	6037	Draw Poker (Extended BASIC Command Module required)	14.95
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OTHER APPLICATION PROGRAMS

Command Modules

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PHM	3058	Mini-Memory	74.95
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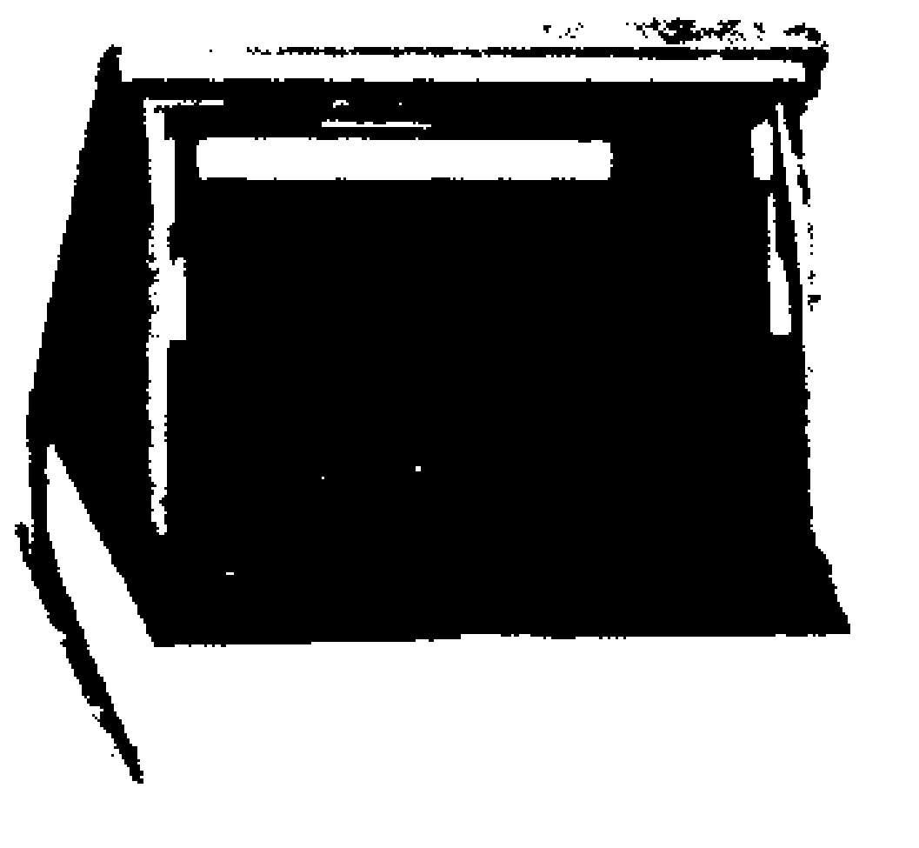

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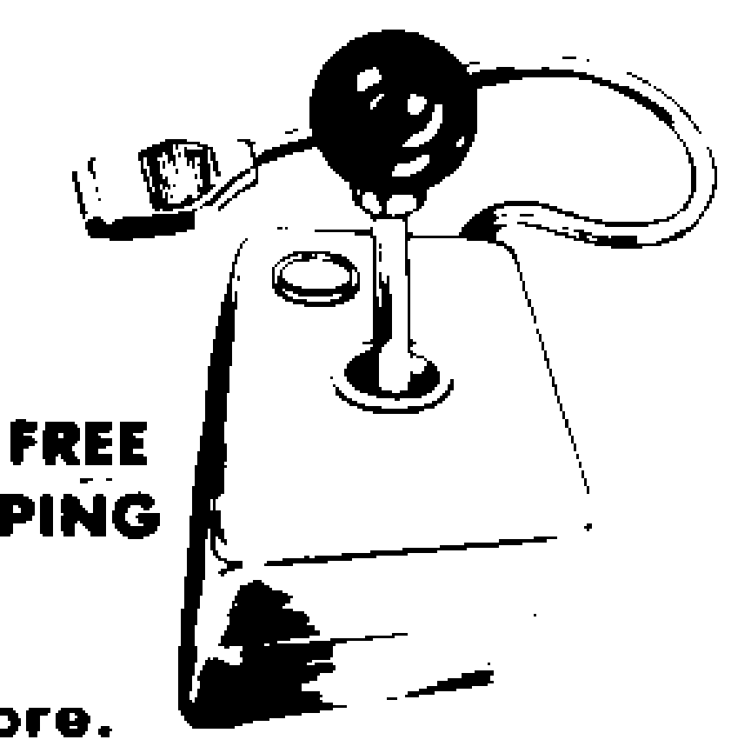

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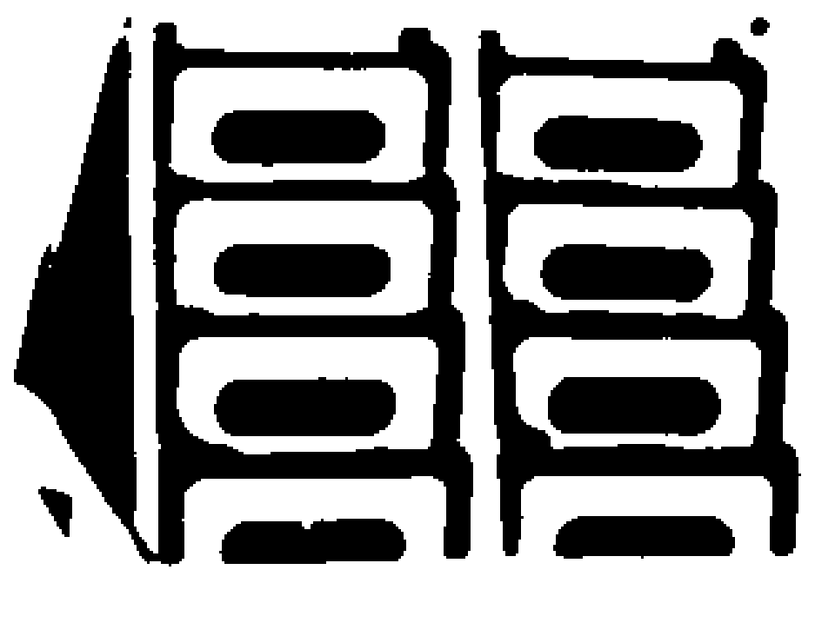

TI99/4 Compatible

SPECIAL - 8

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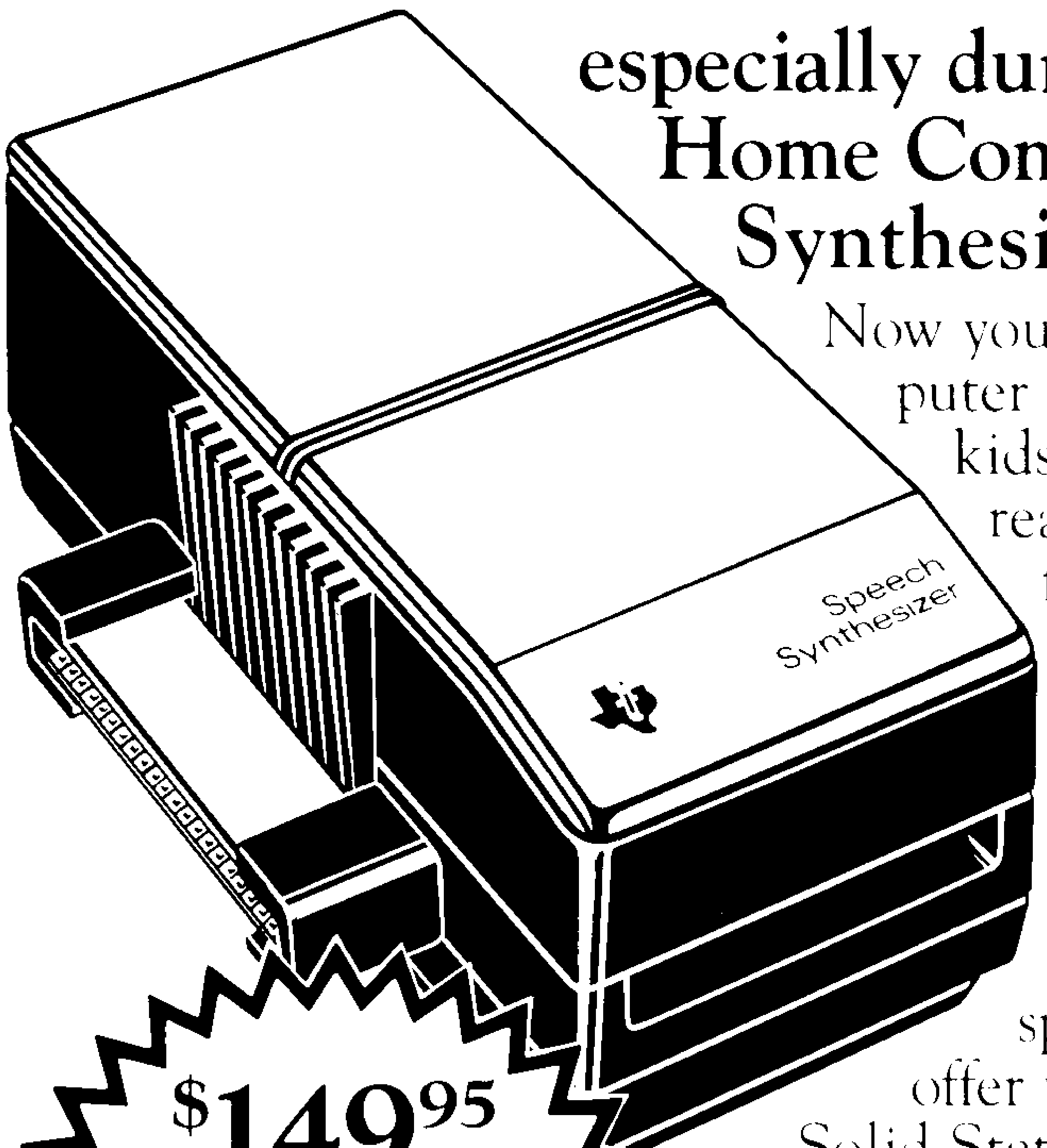

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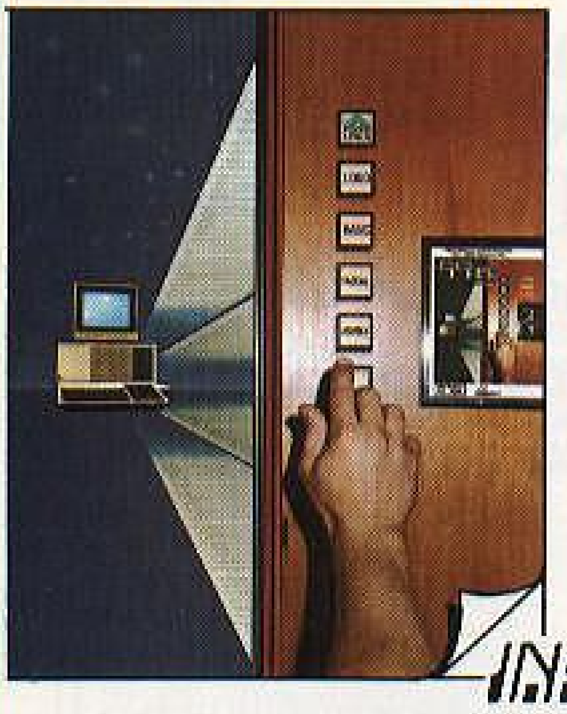
OUTSIDE 99'ER



This Issue's Cover

*The important concept of **choice** when communicating in computer languages is symbolically shown on this issue's cover through the composite art magic of Hayder Amir. Some of the many languages presently and soon to be available for use with the Home Computer are strategically assigned relative "levels" of user-friendliness in the man-machine interactive process. The familiar image within the elevator's license frame suggests the recursive role of the magazine in aiding communications understanding between users and their Home Computers.*

INSIDE 99'ER

Proficiency in computer languages is the magic key that opens the door to meaningful communication between you and your Home Computer.

Inside 99'er this month are answers to many of the perpetuated myths and mysteries about computer languages. Our leadoff article, *Chatting with Your Micro: Languages for the Home Computer*, is a beginner's tutorial that describes the evolution and characteristics of these languages with what (we hope) is refreshing clarity. The tutorial closes with a handy reference chart that, for the first time in print, puts into perspective the language choices a Home Computer user really has.

One of the first language choices a user will want to make is whether or not the built-in BASIC language is adequate for all intended machine uses, or some *extended* features are needed. We think you'll appreciate hearing about one user's experience in *Taking It Home—A Moving Moment: A Review of Extended BASIC.*

Now that you have a new *Extended* understanding of language BASICs, it's time to add style. In *LOGO Has Style*, one of our prolific TI LOGO gurus will show you how to simulate an oracle with a well structured LOGO program. The oracle may not have *all* the answers, but we do learn that mysteriously lurking another place in the magazine is a *second* oracle who perhaps does . . . Hint: Check out *Sub-Programs in Extended BASIC*.

Leaving the land of the oracles behind, we venture into the small, but colorful world of *ASPIC: A Language For Children*. There is much to learn here about how a language functions. Children (and adults who "think young") will especially enjoy a new-found control over color screen graphics that, for the first time, is made possible on a "bare-bones" system through this new super-friendly language . . .

Generating fantastic screen graphics is "old hat" to some readers. But short of taking a photograph of the screen, it's been next to impossible to get a paper copy of the computer art. Fortunately, this problem is now a thing of the past if you follow the instructions in *A Screen Dump Utility—Part 2*. This *Super Language* tool is designed to reside in the new TI Mini-Memory Command Cartridge, and will work with the new TI Impact Printer or Epson MX-80.

If printing *words* rather than graphic images, is your cup of T(I), you'll be happy to learn about a new, very low cost correspondence-quality peripheral in *A Review of the Smith-Corona TP-1 Daisy Wheel Printer.*

The age of portable computing is now upon us. Since we want our readers to stay abreast of new trends in the home computing world, we've started a new magazine-within-a-magazine, *Portable Computing Magazine (PCM)*. Explore the pages of PCM to learn about portable computers and portable software.

A good place to start is *The p-System on the Home Computer*—the first in a series of tutorials about the microcomputer community's only truly portable operating system. Then, for background on where the UCSD p-System has been and where it is going, read *Portable Program Development and the p-System: An Interview with a Pioneer*.

Rounding out the PCM offerings in this premier issue is a look at two pieces of very different hardware—the first is a *TM990/602 Computer Board System Kit* that runs the p-System, and the second will give you some idea of what can be expected when you finally wind up with some basic computing *Power in Your Palm.*

If *Portable Computing* isn't exactly your "game," try another of our magazines-within-a-magazine, *Computer Gaming*. If you don't have time or like to type very much, take a cruise aboard *Professor Holl's Pocket Battleship* to gain your "sea legs."

Then lurking beneath the waves, in your very own WW II submarine, you can give the command, *Up Scope!*.

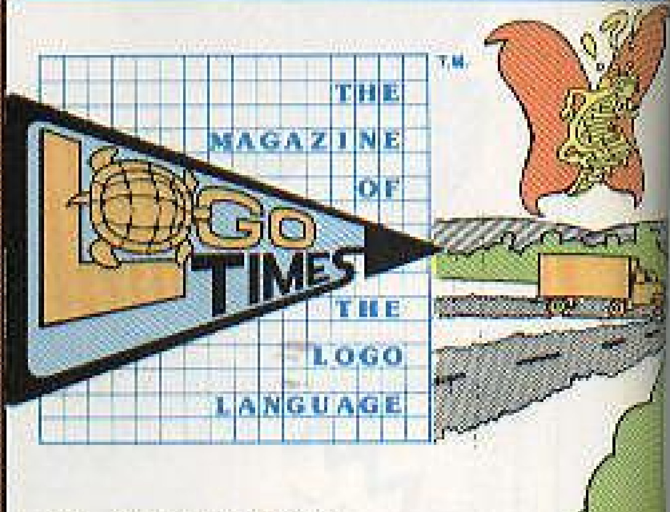
If you're tired of being preyed upon by bigger fish, take note. In *Micro Jaws*, you get to play the role of the predatory shark who devours the smaller fish with his awesome teeth.

After getting all wet in these Extended BASIC games, you'll want to come back up on dry land and take a TI BASIC *Knight's Tour* around a special chess board. It's fantastic fun for the entire family. And while you're at it, don't overlook all the gaming features—there are reviews aplenty, strategy gems, colorful artwork, and much, much more.

Until next month, have fun reading, learning and RUNing . . . 99'er

PORTABLE MAGAZINE COMPUTING

56. The p-System on the Home Computer —*By David G. Brader*
57. Portable Program Development and the p-System: An Interview with a Pioneer
58. Power in Your Palm: A Brief Encounter With the TI-88—*By Walter Hego*
59. A Review of the TM990/602 Computer Board System Kit—*By David G. Brader*



THE MAGAZINE OF LOGO TIMES THE LOGO LANGUAGE
T.M.

50. LOGO Has Style —*By Roger B. Kirchner*
52. Letters on LOGO

Programming Conventions

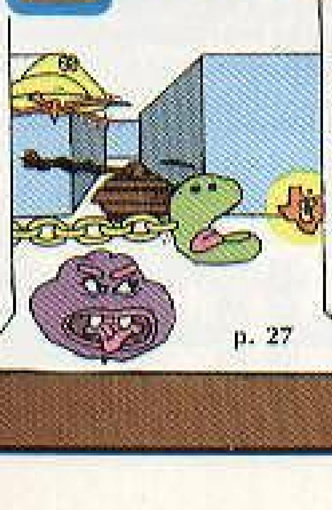
KEY-IN REFERENCE

```
ABCDEFGHIJKLMNOPQRSTUVWXYZabcd
efghijklmnopqrstuvwxyz0123456789
!@#$%^&*()+=-/"[]_?'";:<>,.{}\
```

=Program as listed will completely fill available memory of TI-99/4A and cannot be RUN with disk controller (and possible RS232 interface) turned on. It must be SAVEd and RUN from cassette. It may also possibly be SAVEd and RUN from disk in Extended BASIC with the 32K memory peripheral if the last 2 character sets were not used.

99'er =End of Program or Article

computer gaming



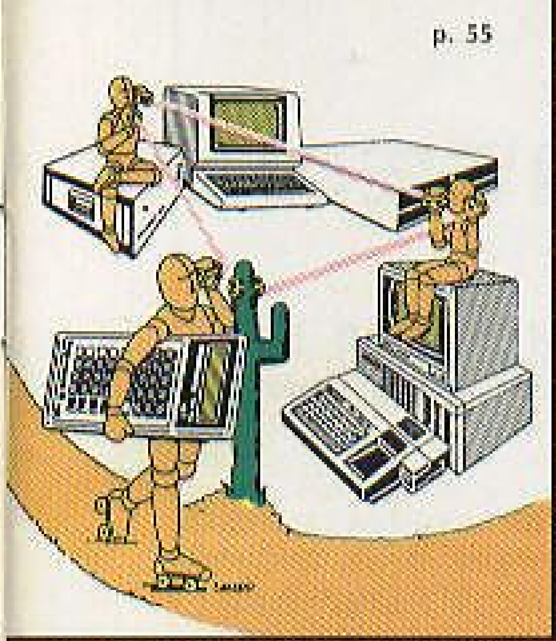
33. Professor Holl's Pocket Battleship —*By S.T. Holl*

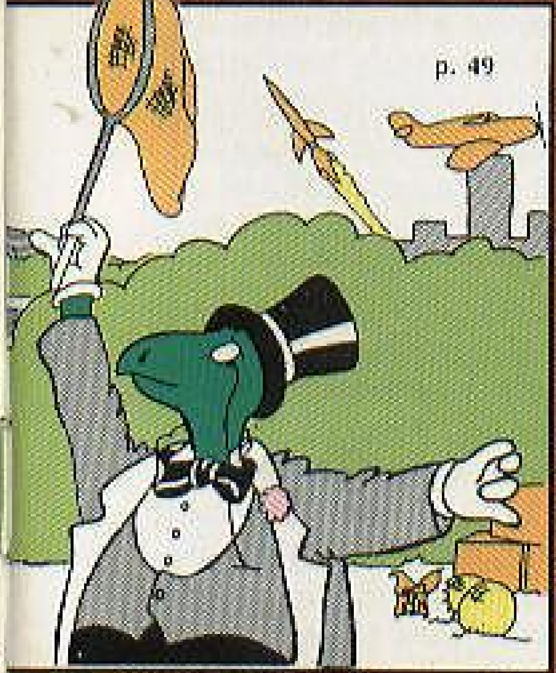
Joystick calculation pg 7

99'er magazine™

November, 1982

Vol.2,No.1





99'ER VERSION

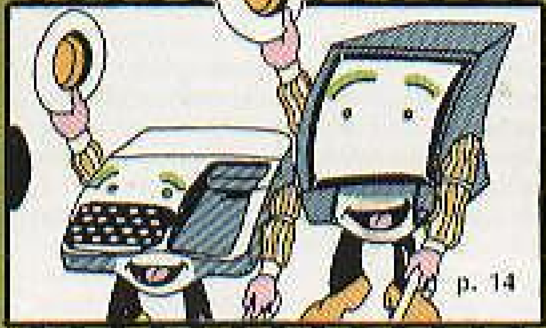
2 . 1 . 1 . XB AL MM EM

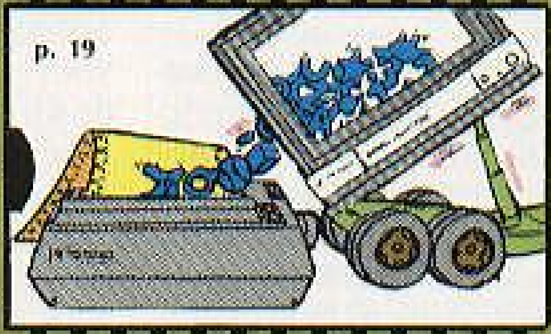
volume no.
issue no.
version
1 = original program
2
.
.
. = no. of update
n
TI Extended BASIC
Assembly Language
Mini-Memory Required
32K Expansion Memory Required

9. **Chatting with Your Micro: Languages for the Home Computer:** *—By David G. Brader & Gary M. Kaplan*

11. **A Review of the Smith Corona TP-1 Daisy Wheel Printer** *—By Walter Hego*

14. **Taking It Home—A Moving Moment: A Review of Extended BASIC** *—By Gregory Kean*

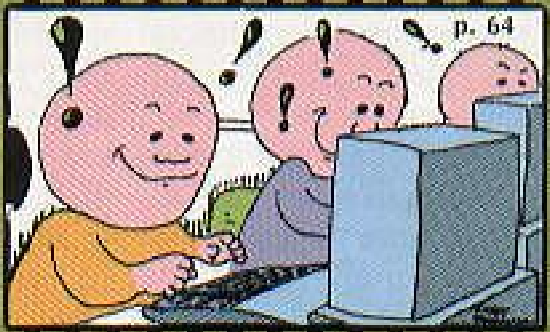




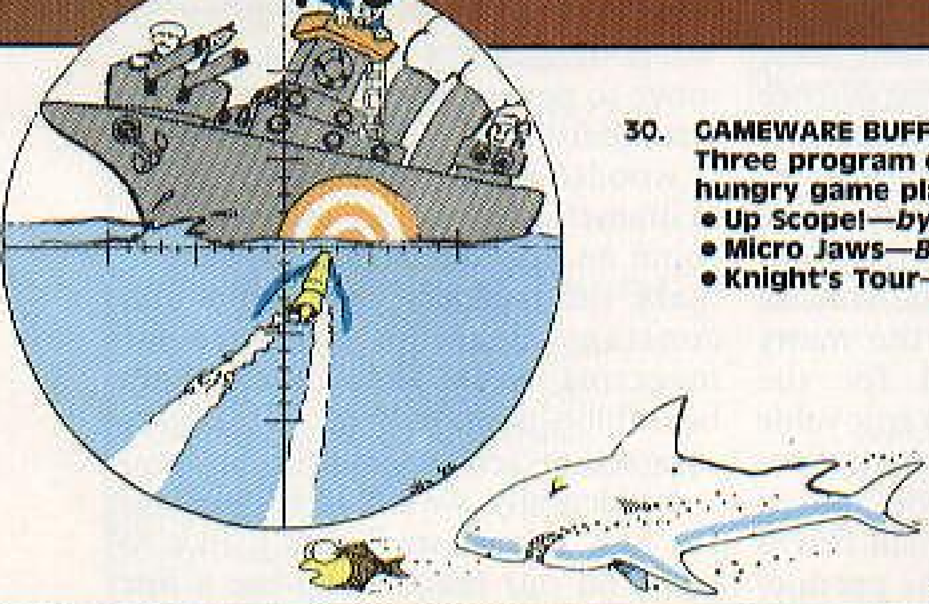
15. **Sub-Programs in Extended BASIC** *—By Roger B. Kirchner*

19. **Super Language: A Screen Dump Utility—Part 2** *—By Patricia Swift*

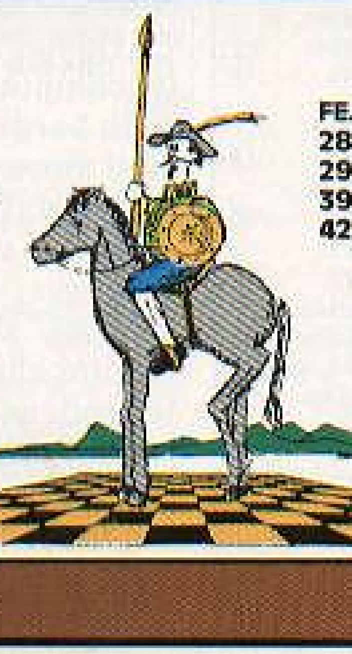
64. **ASPIC: A Language for Children** *—By Kathleen Martin and Andrew Berner*



4. Inside 99'er
6. On Screen
7. Letters to the Editor
22. 99'er Digest
40. Debugs on Display
72. 99'er Shopping Bus
74. Dealer Directory
78. Index to Advertisers



30. **GAMEWARE BUFFET**
Three program entrees for the hungry game player.
- Up Scope!—*by James R. Dew*
- Micro Jaws—*By Samuel Pincus*
- Knight's Tour—*By Curt Garcia*



FEATURES

28. Adventure Registry
29. Arcade Arbiter Review
39. Strategy Corner
42. 99'er Hall of Fame

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A Resource for People Interested in the Enrichment of Personal Computing

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ON SCREEN

By Gary M. Kaplan
Publisher & Editor-in-Chief

I hope you didn't miss noticing it on the cover. After all, we really tried hard to come up with a tasteful-yet-effective way to catch your attention and get the message across that **We're Now Monthly!**

This important change comes at a point in time far ahead of even my most optimistic prediction of last year. Conversion from a bimonthly to a monthly publication is a major accomplishment for us. But this is *your* accomplishment too, because without the high level of support and encouragement from *you*, our readers and advertisers, the change would have been impossible.

In line with this shifting of publication gears, we've made some important new additions to our editorial and production departments. As you can well imagine, we've had to increase the size of our staff to be able to put out a magazine like this twice as often. Among other things, this means that a whole crew of technical writers, editors, and contributing authors must work together under one coordinator so that the entire editorial process runs like clockwork.

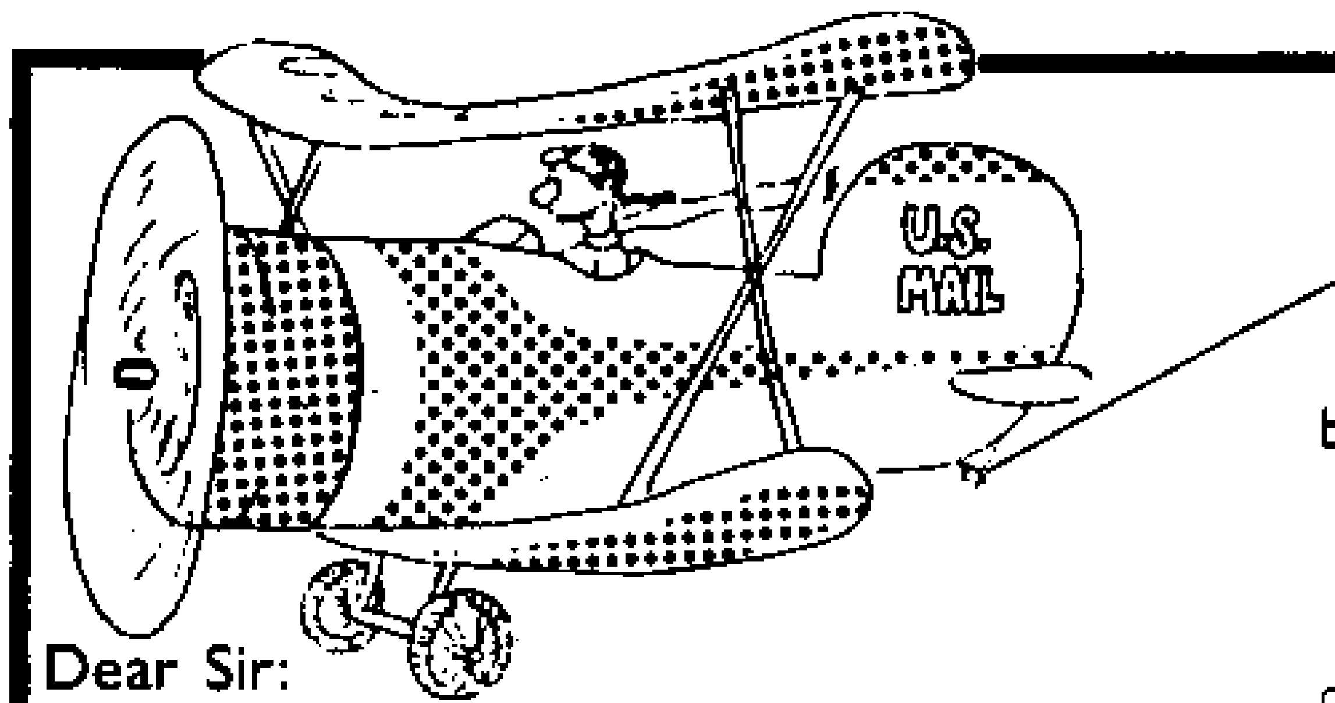
We've been fortunate to get David Brader, who had formerly been serving as one of our technical editors, to take on this new super-challenging assignment of Managing Editor. Besides being an author and editor, David has two decades of experience in computer specialities—spanning both hardware and software design. And since David is especially adept at explaining difficult-to-grasp technical concepts in clear, concise language, he'll see that the many tutorial articles planned for the months ahead remain both enjoyable to read, as well as highly instructive.

But editorial alone, does not a magazine make . . . So when David sends off his material to the production department, our Production Manager, Norman Winney, sees that the graphic treatment for each article and feature gets done, and that all editorial material and advertising fits the allotted number of pages for the issue. It isn't an easy job, by any means—expecially when several of our editors are constantly hounding Norm (affectionately known around here as "Space Miser") to make sure that the piece they've personally been nurturing does, in fact, make it into the current issue.

For those of you who have requested larger-size program listings, you'll be happy to learn that our Space Miser has had a recent change of heart, and has decided to yield to your wishes. This should help cut down on the number of typing errors that always seem to creep in when entering software into your Home Computer. Incidentally, our production department, recently beefed-up with some new, creative talent plus a truckload of state-of-the-art machinery, is eager to show you what they're now capable of doing . . . So expect to see some colorful and exciting graphic treatments in issues ahead.

Providing suitable working space to house our rapidly increasing staff, expanding research and development facilities, and impressive arsenal of computerized production equipment will no longer be a problem. A recent move to new corporate and editorial headquarters, situated in a beautifully wooded office park alongside the Willamette river, has given us the room and conducive atmosphere to make the typically long hours and constant deadline pressure of magazine work that much more bearable—perhaps even (if I may says so, myself) enjoyable . . .

Incidentally, we still have openings for new talent, so if you'd like to work on our team, drop me a line with your qualifications.



LETTERS TO THE EDITOR

Dear Sir:

Many thanks and praises to Regena for a delightful program, "Name That Bone."

I work as a volunteer at school helping a fourth grade teacher once a week. The class had just finished a unit on human skeletal bones when I saw this program. I immediately copied it and brought it into school. All the children loved it! The teachers also were impressed! I think this certainly puts a feather in the TI-99/4's cap as far as its programming capabilities are concerned—even in BASIC. (Can't wait to see what Extended BASIC can do!)

Since my husband and I are new to the computer world, we have come to depend upon the 99'er Magazine to answer many of our questions, and with each issue, we look for an article that might help us with further programming. Excellent magazine!

Question—Has anyone discovered a method to make programs print information, etc., where they want it on the screen—rather than the bottom line. I have a math program that I want to have print in the middle of the screen & on one line:

Ex. "A + B = ?"

Again, many thanks for a superb magazine.

Carol A. Bax
Lynnfield, MA

We thank you for the praises, Carol. One way to answer your question is by advising you to purchase the TI Extended BASIC cartridge. This language will solve the problem with the "DISPLAY AT" and "ACCEPT AT" commands. Until your XBASIC cartridge arrives, try the "DISPLAY AT" technique, courtesy of Mr. Sabo, whose letter follows below.

Dear Sir:

I want to say how absolutely "super" I think your magazine is. Besides being full of interesting and informative articles, it's very attractively produced.

The following is my method of displaying messages in TI BASIC, and I thought it might be of interest to your other readers. Its advantage is that it does not require many instructions per page of messages displayed, and it makes it easier to read through the program and picture its output.

```
100     DIM M$(20)
        .
        .
300     M$(1)="0203:THIS IS MESSAGE
        1"
310     M$(2)="1207:CHEERS, FROM
        CANADA!"
320     M$(3)="2003:LAST MESSAGE
        THIS SCREEN"
330     GOSUB 10000
        .
        .
        .
10000   REM 'DISPLAY AT' ROUTINE
10010   FOR N=1 TO 20
10020   IF M$(N)="" THEN 10100
10030   R=VAL(SEG$(M$(N),1,2))
10040   C=VAL(SEG$(M$(N),3,2))-6
10050   FOR I=6 TO LEN(M$(N))
10060   CALL HCHAR(R,C+I,ASC(SEG$
        (M$(N),I,1)))
10070   NEXT I
10080   M$(N)=""
10090   NEXT N
10100   RETURN
```

Messages for the next screen would begin M$(I)=...etc.

Since the row and column parameters are specified by the programmer, the routine is user-proof.

Larry Sabo
Kanata, Ontario Canada

Thanks for the tip, Larry. Including the row and column numbers in the message string format was a great idea.

Dear Sir:

After having invested in a TI-99/4 and almost all the peripherals including an Epson MX-80 printer, your magazine has become almost essential to my mental health.

I don't know if there are any other TI owners in the New Orleans area. If you have other subscribers here, is there any way you can help us get together? Part of the fun for me is programming, but I'm no genius and it would be nice to discuss problems with others.

For instance, I can't find out how to get sprites to leave a trail. I am interested in displaying graphs of polynomial equations but the 24×32 screen is much too coarse. I can make a sprite trace the graph, but there is no line remaining.

Charles C. Foster
Gretna, LA

Entering 99'er Programs

New readers should be aware that within the magazine's pages are found actual computer programs that *you* can put into your Home Computer and enjoy.

Make sure you have any special system components required by the program (i.e., the Speech Synthesizer, Extended BASIC cartridge, etc.). Then, using the console keyboard, you can type the printed magazine listing (character for character, and line by line) into the computer's memory.

Before entering the program, connect a cassette recorder to the computer. Make sure you have two blank cassette tapes. For each 10-20 lines you type in, use SAVE CS1 to save that program segment onto one of the tapes. Alternate between the two tapes each time you save the program. Be sure to rewind to the beginning of each tape before saving, so that you always record over and replace the shorter segment of program lines with the longer segment. By following this procedure, you'll always retain most of your work even if the lights go out or someone turns off the computer.

Double check your typing against the program listing for errors, and *then* have someone else check it. The most common errors are typing the letter "O" instead of the number "0" (zero)—they are *not* interchangeable to the computer. This is also true for the letters "I" and "L" and number "1" (one). [See "Key-In Reference" on p. 4]

Every time you make a correction to your program, SAVE CS1 and switch the tapes. Once all the errors are corrected, you will have a good copy of the program on the last tape. Before turning off the computer, put the other cassette tape in your recorder and once again SAVE CS1. Now, if one tape gets damaged, you won't have to enter the program listing via the keyboard all over again. Have fun and happy computing.

Hey, all you New Orleans TI owners: Who should Charles contact? Charles, you'll be glad to hear that an article addressing dot screen graphics is being typeset right now, watch for it in the next issue.

Dear Sir:

It could be that I have "re-discovered the wheel," and old-time TI-99/4 programmers will smile and nod their heads. . . but here goes anyway:

In writing a program for the joystick, I was troubled by the necessity of coding eight IF-THEN-ELSE statements to test the location and action required based upon the joystick handle position. So I combined the X-Y output in the following equation:

$$Z = ((X + 3 * Y)/4) + 5$$

This gives the integers 1 to 9 for any joystick position. Then, with the addition of a simple ON Z GOTO, or ON Z GOSUB statement, I have tested all conditions and made the appropriate transfer.

David N. Lewis
Gastonia, NC

A valuable suggestion, David. See the solution to the problem in the next letter for an application of your idea.

Dear Sir:

Although hoping that before long "99'er" will go monthly, I feel that your magazine is worth every day of the two-month wait between issues, particularly for the program listings.

I would like to pass on a couple of things. The first is a request: In listings for games which are adaptable to joysticks, but not written that way by the author, could you include the alternate coding necessary? For example, an outstanding game like "Force 1" (Vol. 1, No. 5) would be far more enjoyable without the distraction of the keyboard. I've tried everything I can think of to write a joystick into that program but can't get it to work properly. I'm sure many of us "tyros" out here would appreciate the solution to this (if there is one).

Secondly, here's a helpful hint for anyone having problems saving or loading on cassette: Your grief may be caused by the tape and not by the recorder. Despite the well-intended suggestions in the addendums packed with the 99/4A console, some of the "tested-OK" cassettes (i.e. TDK Super Avilyn) are the high-bias type and aren't compatible with the majority of small battery-operated recorders. By switching to normal-bias cassettes, you can save a lot of frustration and money too. (What this country really needs is a good $50 disk drive!)

Keep up the good work.

Don Handley
San Dimas, CA

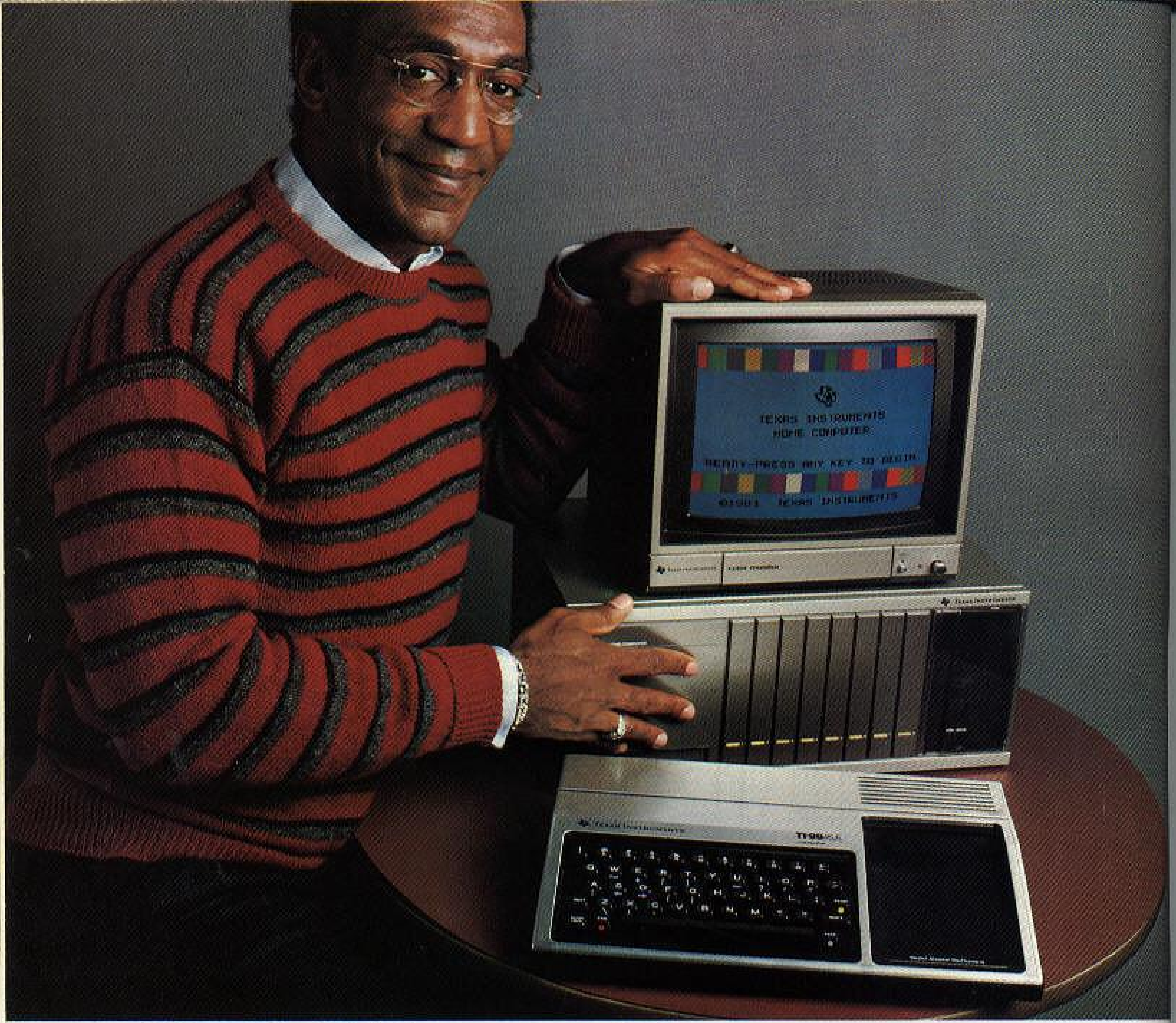
Don, your hope has just come true. You can expect your next issue about 30 days from now. Yes, 99'er is now being published monthly!

Below is one solution to adding joysticks to "Force 1." Well, don't just sit there! Go turn on your computer and try it . . .

Changes to Force 1 for joysticks:

```
222     CALL CLEAR : : DISPLAY
        AT(2,1): "JOYSTICKS? (Y/N)"
224     ACCEPT
        AT(2,17)VALIDATE("Y,y,
        N,n"):J$ : : IF
        (J$="Y")OR(J$="y")
        THEN JS=1 ELSE JS=0
510     GOSUB 700 : : GOSUB 850 : :
        GOSUB 1390
520     IF JS=1 THEN GOSUB 1620 : :
        GOTO 530
525     CALL KEY(0,K,S)
530     CALL POSITION(#1,PO1,PO2)
1620    REM *** JOYSTICK USAGE
1630    REM FIRST CHECK FIRE
        BUTTON.
1640    CALL KEY(1,K,S) : : IF K=18
        THEN K=13 : : RETURN
1650    REM NOT FIRE BUTTON CHECK
        JOYSTICK
1660    CALL JOYST(1,JX,JY)
1670    JZ=((JX+3*JY)/4)+5
1680    ON JZ GOTO 1730,1690,1730,
        1700,1730,1710,1720,1730
1690    K=88 : : RETURN
1700    K=83 : : RETURN
1710    K=68 : : RETURN
1720    K=69 : : RETURN
1730    K=0 : : RETURN
```

Continued on p. 21



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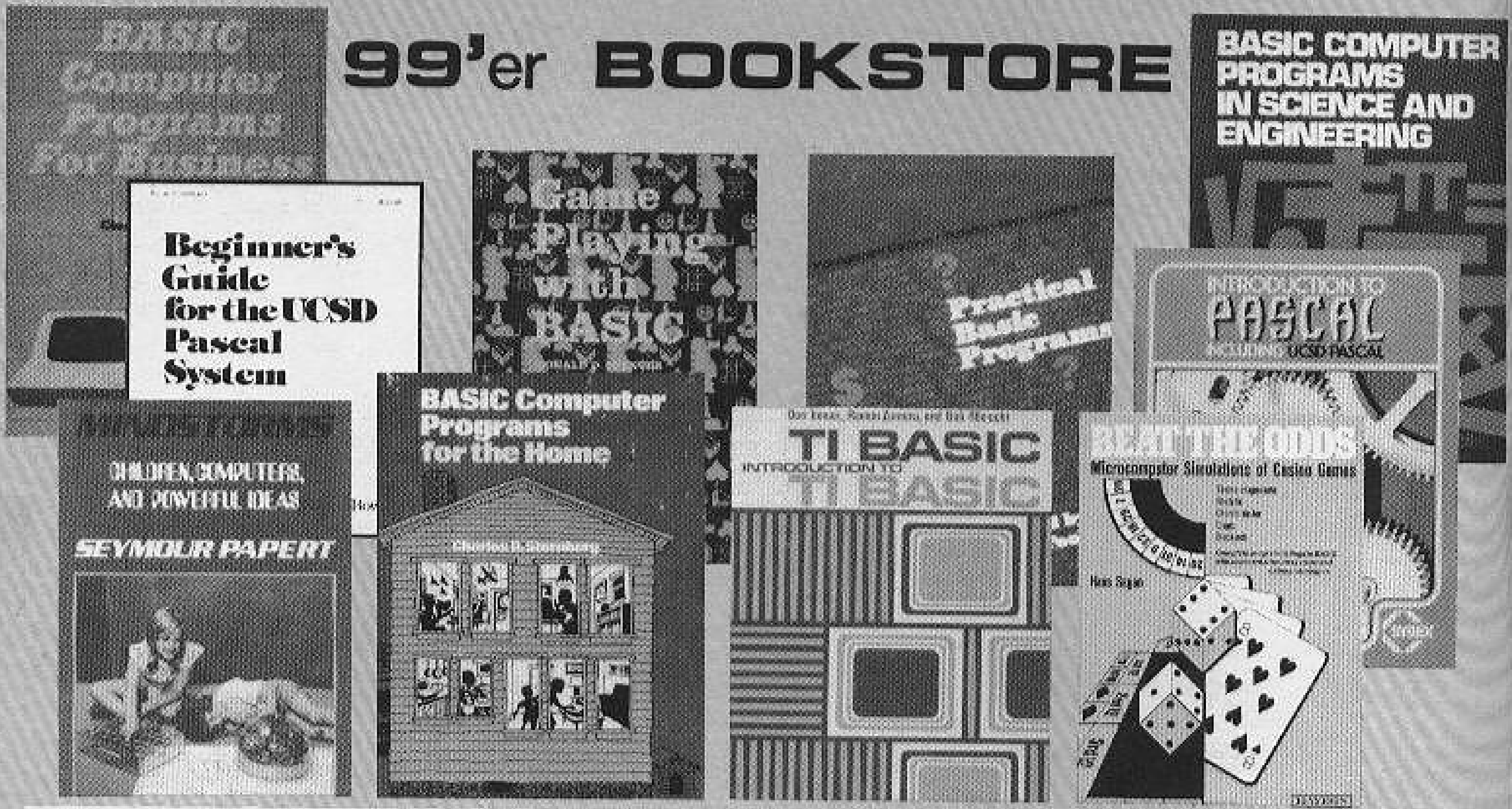
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BEAT THE ODDS Microcomputer Simulations of Casino Games
Hans Sagan

MINDSTORMS: CHILDREN, COMPUTERS AND POWERFUL IDEAS

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By Seymour Papert
The definitive work on the philosophy behind LOGO. Excerpted in the Vol. [illegible] No. [illegible] issue of this magazine.

Hardcover, **$13.95**
1980, 230 pages, 6 x 9

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paper, **$16.50**
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INTRODUCTION TO TI BASIC

By D. Inman, R. Zamora,
and R. Albrecht.
This comprehensive work will teach you all about computers and BASIC for use with the Texas Instruments Home Computer. Even if you've never worked with a computer, you can now teach yourself how to use, program and enjoy the TI Home Computer with this entertaining, and easy-to-read work. The authors have carefully constructed this introduction so that you will soon be writing BASIC programs and exploiting all of the excellent features of the TI machines. Its 14 chapters and Appendices cover all of the essential programming statements and machine features.

paper, **$12.95**
1980, 384 pages, 7 x 10

INTRODUCTION TO PASCAL (INCLUDING UCSD PASCAL)

By Rodnay Zaks
This is the first book on Pascal that can be used by persons who have never programmed before, but more generally it is a simple and comprehensive introduction to standard and UCSD Pascal for anyone—beginner to experienced programmer—who wants to learn the language rapidly. The logical progression and graduated exercises—designed to provide practice as well as test skill and comprehension—enable the reader to begin writing simple programs almost immediately.

paper, **$16.95**
1981, 440 pages, 7 x 9

BEAT THE ODDS: MICROCOMPUTER SIMULATIONS OF CASINO GAMES

By Hans Sagan.
Here's an extremely useful programming guide that provides realistic simulations of five popular Casino games: Trente-et-Quarante (Thirty and Forty), Roulette, Chemin-de-Fer, Craps, and Blackjack. Each of the five chapters has the same structure. It begins with a computer run, displaying facets of the programs, followed by an explanation of the objectives and the physical execution of the game. Acceptable bets and how to place them are discussed and systems and/or strategies laid out. Finally, the computer program is developed and various modifications of the program are detailed.

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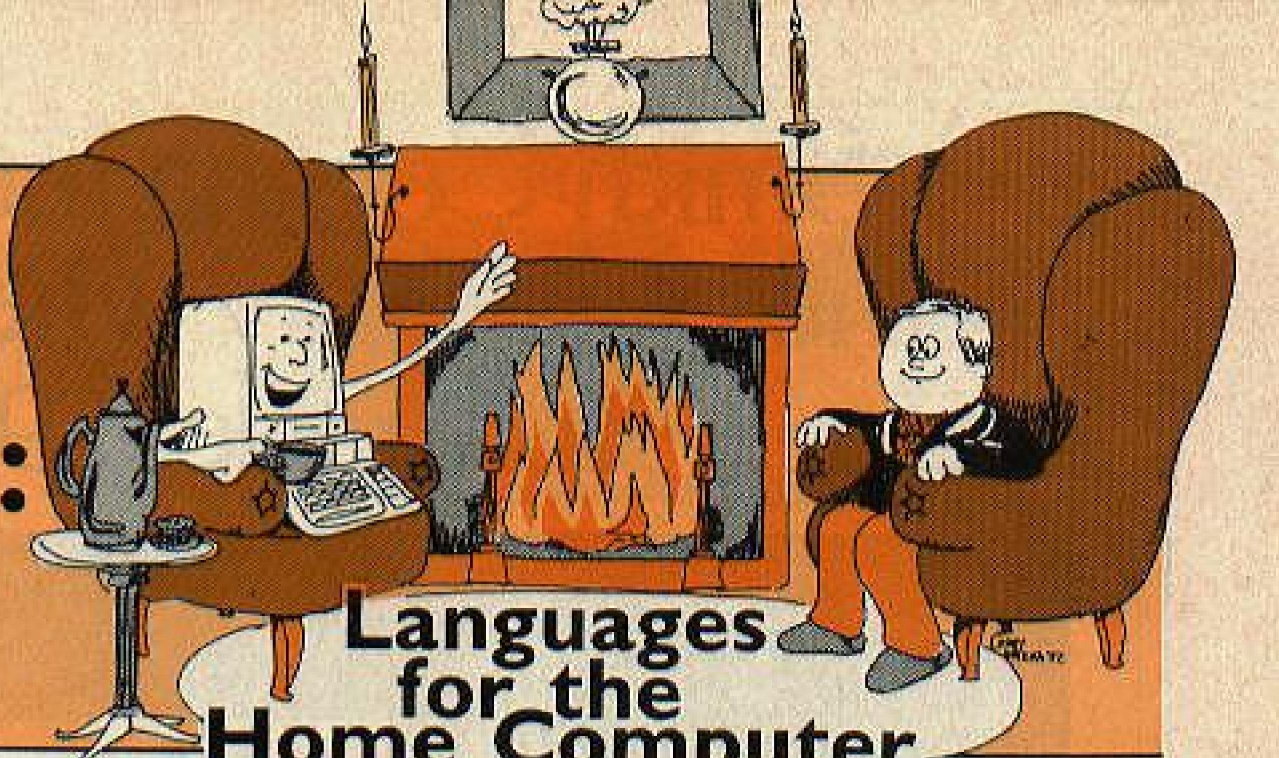


Languages for the Home Computer

By David G. Brader
and Gary M. Kaplan

Home Computers are indeed wonderful machines. They have been carefully designed to allow beginners to do meaningful tasks, act as educational tools, and provide hours of inexpensive family entertainment.

All of this is made possible by the availability of "user-friendly" software—Command Cartridges, cassette tapes, and floppy disks that have been pre-recorded with programming instructions the computer can understand and carry out.

Users of this software need not and often will not concern themselves with how this programming was actually produced—unless, of course, they get smitten with a bout of that highly contagious human germ known as "curiosity," and want to understand something about the process.

"Programming" a Home Computer is *not* some mysterious rite that is meant to be practiced by a select few in secrecy, hidden from the eyes of users. Rather, it is simply a means of communicating with a machine in a language that *both* humans and human-designed electronic circuits can understand—nothing more elaborate than basic, down-to-earth communication.

Languages, whether human-to-human or human-to-machine, differ widely in their complexity. Depending on the language, varying amounts of memorization and practice are required before a "speaker" can communicate effectively. The levels of computer language complexity run the gamut from conversational English phrases, to the on and off switching of electric current that the machine "understands" and transforms into various actions.

Before a user can begin communicating with a computer, however, one of three conditions must be met: (1) The user must be able to communicate in the computer's language; (2) the computer must be able to communicate in the user's language (i.e., English, German, Spanish, etc.); or (3) some common intermediate language must be established, understood, and used by *both* parties. By definition, the closer this intermediate language is to the machine's natural "electrical" language, the *lower* its level. And conversely, the closer to the human's language, the *higher* the level.

Machine Language

First, let's take a look at the lowest level of common intermediate language—referred to as "machine language." Since electricity can either be on or off—one of *two* possible conditions—machine language can only be constructed from *two* "words." This binary language is often expressed by humans with the two digits 1 and 0, with 1 representing the "on" state (presence of electricity), and 0 representing the "off" state (absence of electricity). Absolutely *shocking* in its simplicity, isn't it?

Additional Terms You'll Want to Know

Command Cartridge—A plug-in plastic cartridge from Texas Instruments with integrated circuits that contain a computer program (software).

floppy disk—A mass-storage device using a flexible mylar disk to record information. It is a more sophisticated alternative (quick random access) to cassette tape storage (sequential access).

Home Computer—The Texas Instruments TI-99/4A console with either a home television or TI Color Monitor.

Integrated circuit (IC)—Integrated circuits have many individual components packed together or integrated in a small area. The circuits of the computer are fabricated on silicon chips. A chip is typically about 1/4 inch on a side. Today's chips are so sophisticated that the basic components of an entire computer can be fabricated on a single chip.

mnemonic—Assisting or intended to assist the memory.

screen—The home television or TI monitor to which the computer outputs information like numbers/letters/graphs, etc.

Speech Synthesizer—A peripheral device built by Texas Instruments for use with the Home Computer and used to reproduce the human voice electronically.

TMS9900—A very sophisticated integrated circuit (called a "microprocessor") containing all the most basic components of an entire computer. Designed and built by Texas Instruments, it is the heart of the Home Computer.

Figure 1.

"MACHINE LANGUAGE SAMPLE"

```
0 0 0 0   0 0 1 0   0 0 0 0   0 0 0 0
0 0 0 0   0 0 0 1   0 0 0 0   0 0 0 0
0 0 0 0   0 0 1 0   0 0 0 0   0 0 0 1
0 0 0 0   0 0 0 0   0 1 0 1   0 1 0 0
0 0 0 0   0 1 0 0   0 0 1 0   0 0 0 0
0 0 0 0   0 0 0 0   1 0 0 0   1 1 0 0
0 0 0 0   0 0 1 0   0 0 0 0   0 0 0 0
0 0 0 0   0 0 0 1   0 0 1 0   0 0 0 0
0 0 0 0   0 0 1 0   0 0 0 0   0 0 0 1
0 0 0 0   0 0 0 0   0 0 1 1   0 1 0 0
0 0 0 0   0 1 0 0   0 0 1 0   0 0 0 0
0 0 0 0   0 0 0 0   1 0 1 0   0 0 0 0
```

Figure 1 represents six machine language "sentences." It's not too easy for a human to understand, is it? Yet when communicating this way, more explicit control of the machine is possible, because there can be nothing "lost in the translation."

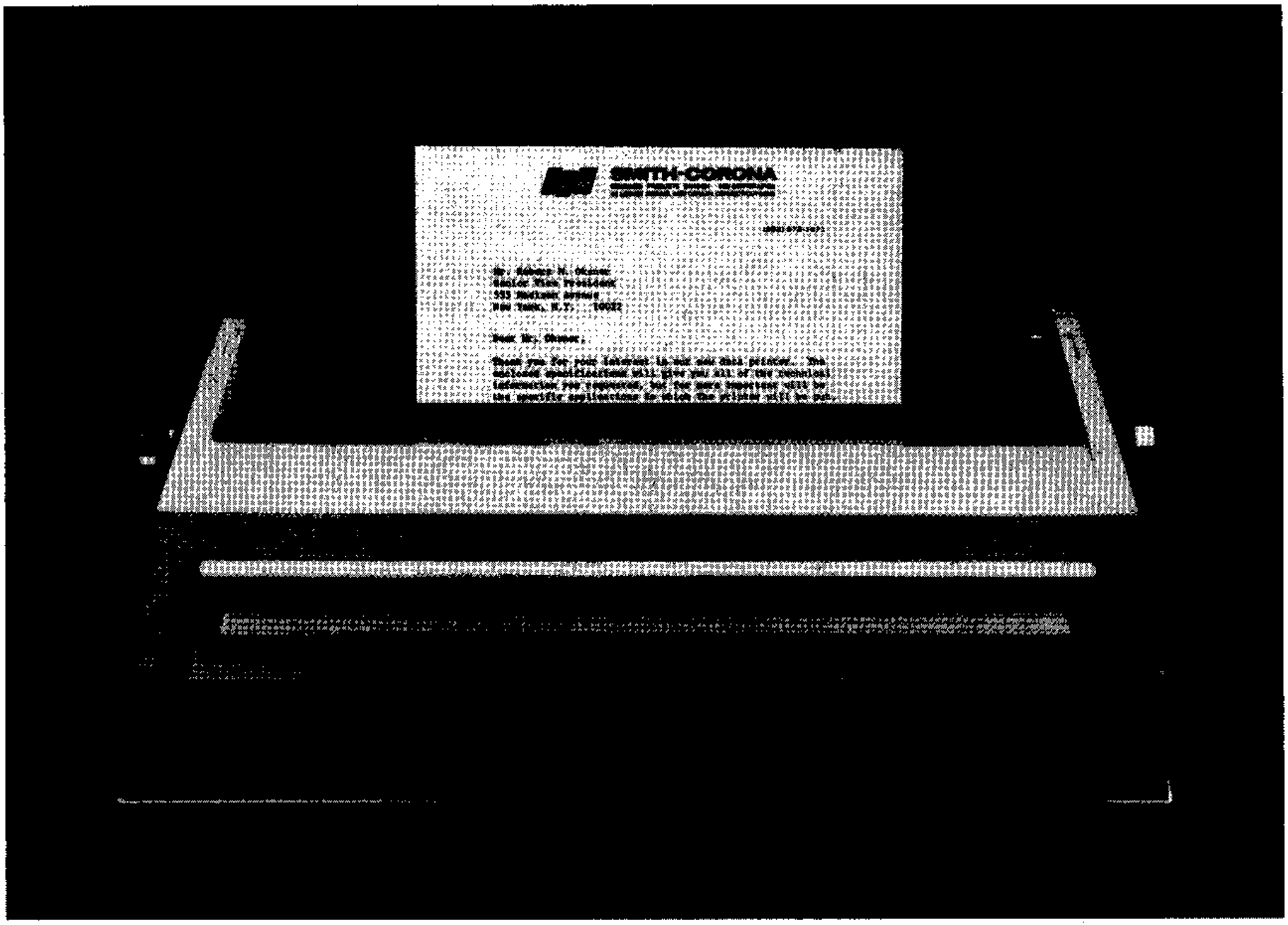
TMS9900 Assembly Language

Human difficulty in communicating in a binary language led to the next step in the evolution of higher-level languages—an easier-to-remember way ("mnemonic") of expressing these binary "sentences." This was done by assigning combinations of alphabetic letters to represent operations formerly only expressable by binary sequences, and assigning a *full range* of digits to represent the things actually "operated" on.

This easier, alphanumeric way of communicating is called "Assembly Language" because these newly created scores of symbols must eventually be translated back ("assembled") to their binary equivalents for the machine to carry them out.

Continued on p. 16

Smith-Corona introduces the only daisy wheel printer for under $900.*



You're putting together a desktop computer system for your office or home. And you want to add a letter quality printer so you can do word processing, too. But you don't want to spend a fortune.

Until now, you really had little choice but to settle for dot matrix printers. True, dot matrix doesn't produce letter-perfect printing, but daisy wheel printers just cost too much. That is, they did.

Now, Smith-Corona® offers a daisy wheel printer at such an incredibly low price, you can't afford *not* to get it. (The fact is, you won't find a daisy wheel printer *anywhere* at a price so low.)

The Smith-Corona TP-I™ printer operates with microprocessor controlled daisy wheel technology, and is available with either standard serial or parallel data interface. It is compatible with most microcomputers currently on the market. And, unlike many printers, it's made in America.

Best of all, the TP-I produces results identical to those of our very finest office typewriters—printing with real character. So it can be used to send out letters that have to look perfect. As well as financial statements, inventory reports, direct mail campaigns, manuscripts. Even a letter to your son in college! Anything at all you need printed.

The basic TP-I will handle letter or legal sized paper. An option that will be available soon will enable it to handle either fanfold or single sheet paper.

The TP-I is easy-to-use—just turn the power on, load the paper, and away it goes. There are drop-in ribbon cassettes and a choice of easy-to-change, snap-on daisy print wheels for a variety of fonts.

So stop thinking you can't afford a daisy wheel printer. Because, thanks to Smith-Corona, a printer with real character is no longer expensive.

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*Manufacturer's suggested retail is under $900, but prices may vary.

A Review
# of the Smith-Corona TP-I Daisy Wheel Printer

By Walter Hego
Technical Editor

When I said I would review a new, low-cost daisy wheel printer, I didn't expect the HUGE box that was delivered to our office door. But once I got over my initial shock and opened the box, I found the not-so-large Smith-Corona TP-I packed *very* well in a large, custom-white-foam, clam-shell container.

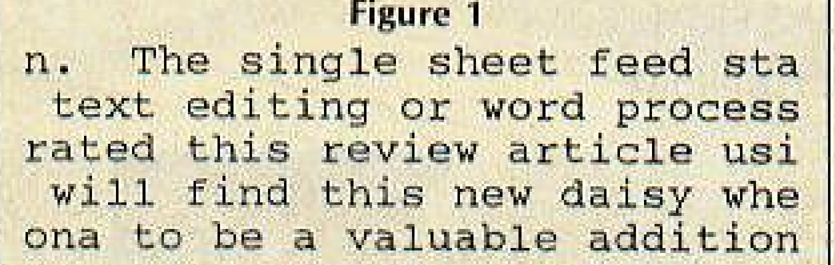
As I carefully lifted the TP-I from its shelter, I noticed the HEAVY-duty construction. With great anticipation, I set it on top of my desk and opened the front cover.

The daisy wheel printing mechanism runs back and forth on a cast aluminum bed. Fastened to the bed is a heavy steel rod that acts as the bearing surface for the movable head machanism. Rather than using a wire (or string) and pulley affair for head positioning, the TP-I has what looks like (to this old sports car buff) a "rack and pinion" positioner. There is a toothed rail (the "rack") running the full width of the carriage mounted on the aluminum bed. A very healthy looking "stepper" motor mounted in the movable head mechanism drives the gear ("pinion") against the toothed rail.

The next thing that impressed me while "under the hood" was the ease in changing the ribbon and daisy wheel. The ribbon is released and raised by one simple lever and can be activated from either side of the ribbon cartridge. Then, it just lifts out . . . And putting it back is just as easy: Place it in the proper position and press . . . No messing around with ribbon guides.

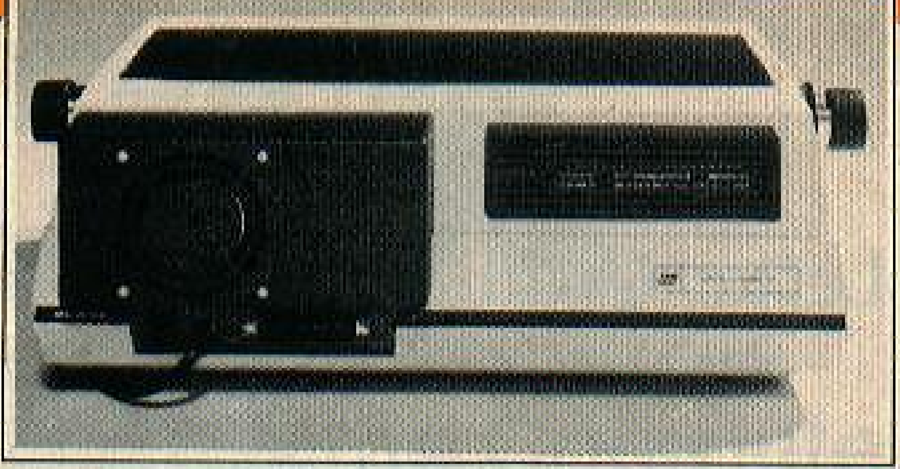
While the ribbon cartridge is out, you can remove the daisy wheel. A small silver dial on the left side of the head mechanism (called the hammer release) is rotated about a one-third of a turn to give immediate access. Grasping the daisy wheel by its hub and pulling back removes it. Putting in a daisy wheel is the reverse of removal. Several different type-styly daisy wheels are available.

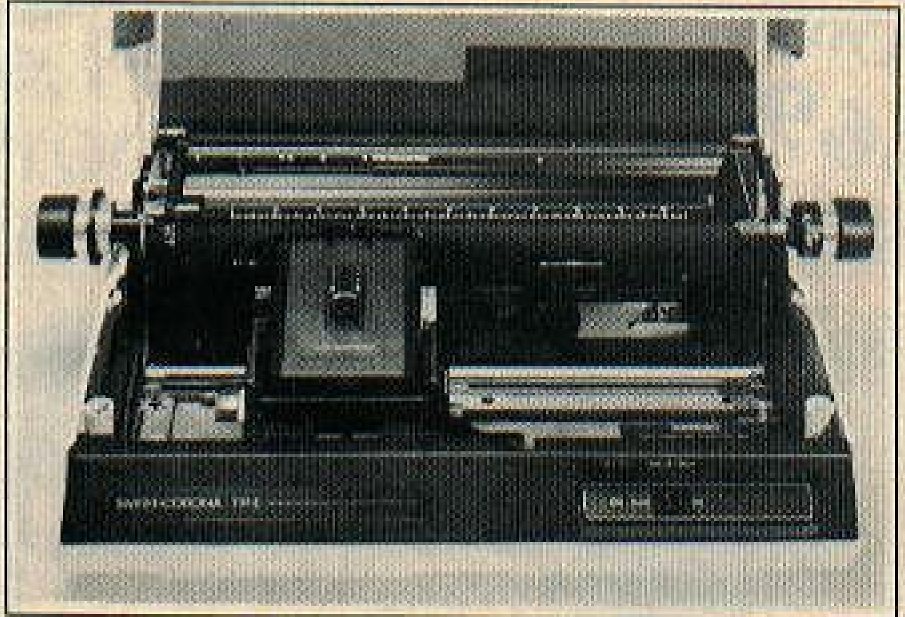
Figure 1



```
n.  The single sheet feed sta
 text editing or word process
rated this review article usi
 will find this new daisy whe
ona to be a valuable addition
```

You can purchase the Smith-Corona TP-I printer in different configurations. It comes with either 10 characters per inch (CPI) or 12 CPI "pitch." You also have a choice of parallel or serial (RS232) interfaces. The average print speed is 12 characters per second. The printing is fully formed correspondence quality (see sample in Figure 1). The carriage is wide enough to place a normal sized piece of paper in the machine sideways. For more specific data see Table 1.





The model TP-I presently connected to my TI-99/4A is a 10 CPI serial interface unit. Although the operator's manual included with the printer showed the connections for the RS232 serial interface and stated that the "baud" rate was selectable by jumpers on the inside, I wasn't told what the rate set at the factory was or how to set up the jumpers. After a couple of hours using the trial and error method, I discovered the TI BASIC "OPEN" statement needed for this printer (connected to Port #1) to be:

OPEN #1:"RS232.DA = 8.BA = 1200"

The manual is very well designed for a novice operator, but leaves a bit to be desired for a person trying to configure his system for the first time.

Once the TI Home Computer was able to talk to the TP-I, I learned how to set the margins. A few minutes of experimentation revealed that transmitting the following sequence of characters did the trick:

CR CAN BS BS BS...BS BS (spaces) **DC1 CR** (spaces) **DC3 CR**

where **CR**, **CAN**, **BS**, **DC1**, and **DC3** are defined on page III-2 of your TI-99/4A User's Reference Guide. The first set of spaces defines the indent to the left margin and the second set of spaces defines the number of characters bet-

Continued on p. 74

Table 1

PRINTING TECHNIQUE	Daisy wheel, fully formed character
PRINT SPEED	12 CPS
CHARACTER SET	128 ASCII, 88 printable
CHARACTER SPACING (PITCH)	10 CPI or 12 CPI
PRINTING	Unidirectional
PAPER WIDTH	13" (33 cm) maximum
WRITING LINE	10.5" (26.7 cm) – 105 character line in 10 pitch – 126 character line in 12 pitch
LINE SPACING	6, 4.5, 3.0 lines per inch
PAPER FEED	Friction: single sheet or fanfold
PAPER THICKNESS	maximum .022" paper thickness
IMPRESSION CONTROL	Operator selectable 5 levels
INTERFACE	
Parallel	7 bit parallel data, 3 control lines (data strobe, busy, acknowledge)
Serial	RS232, Baud Rates – 50; 75; 110; 134.5; 150; 300; 600; 1,200; 1,800; 2,400; 4,800; 7,200; 9,600, 19,200 BPS, Strap selectable. Parity and character bit length also strap selectable.
POWER REQUIREMENTS	117 VAC ± 10%, 60 HZ, 120W
PHYSICAL DIMENSIONS	6.4" (16.25 cm)H; 19.5" (49.6 cm) W; 12.4" (31.5 cm) D; 18.5 lbs. (8.4 kg)
ENVIRONMENTAL	
Operating	55°F to 104°F, 10 to 80% humidity, (no condensation)
Storage	– 40°F to 160°F, 5 to 95% humidity (no condensation)

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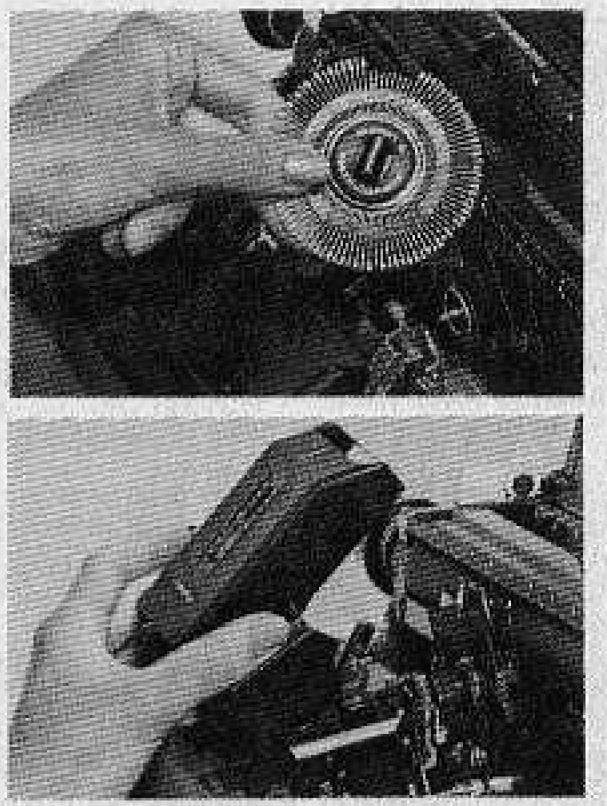
- SERIAL OR PARALLEL INTERFACE
- SIMPLE, RELIABLE MECHANISM

The Smith-Corona TP-I text printer is a microprocessor controlled daisy wheel printer which delivers fully formed executive quality printout at a speed of 144 words per minute. The printer is a simple, low cost, and reliable unit which can be utilized with word processing systems, microcomputers, personal computers, small business systems, or in any environment which requires high quality printing. Its compact size and attractive packaging will allow it to blend into any environment.

The TP-I text printer is easy to use and incorporates a limited number of operator controls. Simply turn power on, load paper as you would with any standard office typewriter, and the printer is ready to go. Drop-in ribbon cassettes and quick change snap-on daisy print wheels are standard features which help make the printer simple to use.



The printer is available with either a parallel or a serial data interface. It prints an 88 character ASCII set in either a 10 character per inch or 12 character per inch version. The 10 CPI model prints a 105 character line while the 12 CPI version expands the line length to 126 characters. Various fonts are available for each pitch and the printer will handle single sheets or forms.

The TP-I text printer is a product of Smith-Corona's advanced technology, capacity for design simplification, parts count reduction, modular construction, mass production techniques, and vast experience in the printing products field. It offers the benefits of a high quality daisy wheel printer at an extremely low cost.

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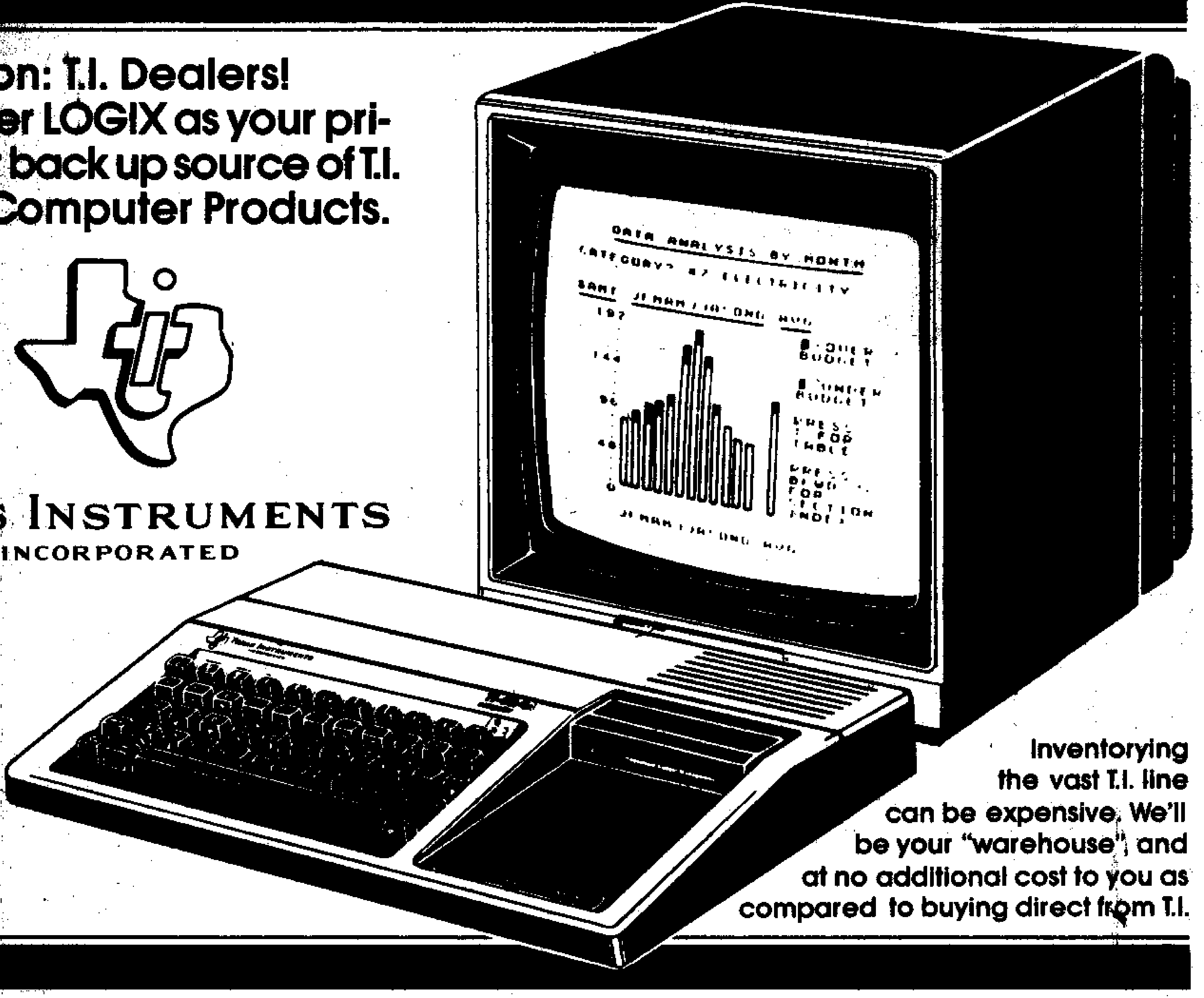
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96
48
0
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Taking it Home - A Moving Moment: A Review of Extended BASIC

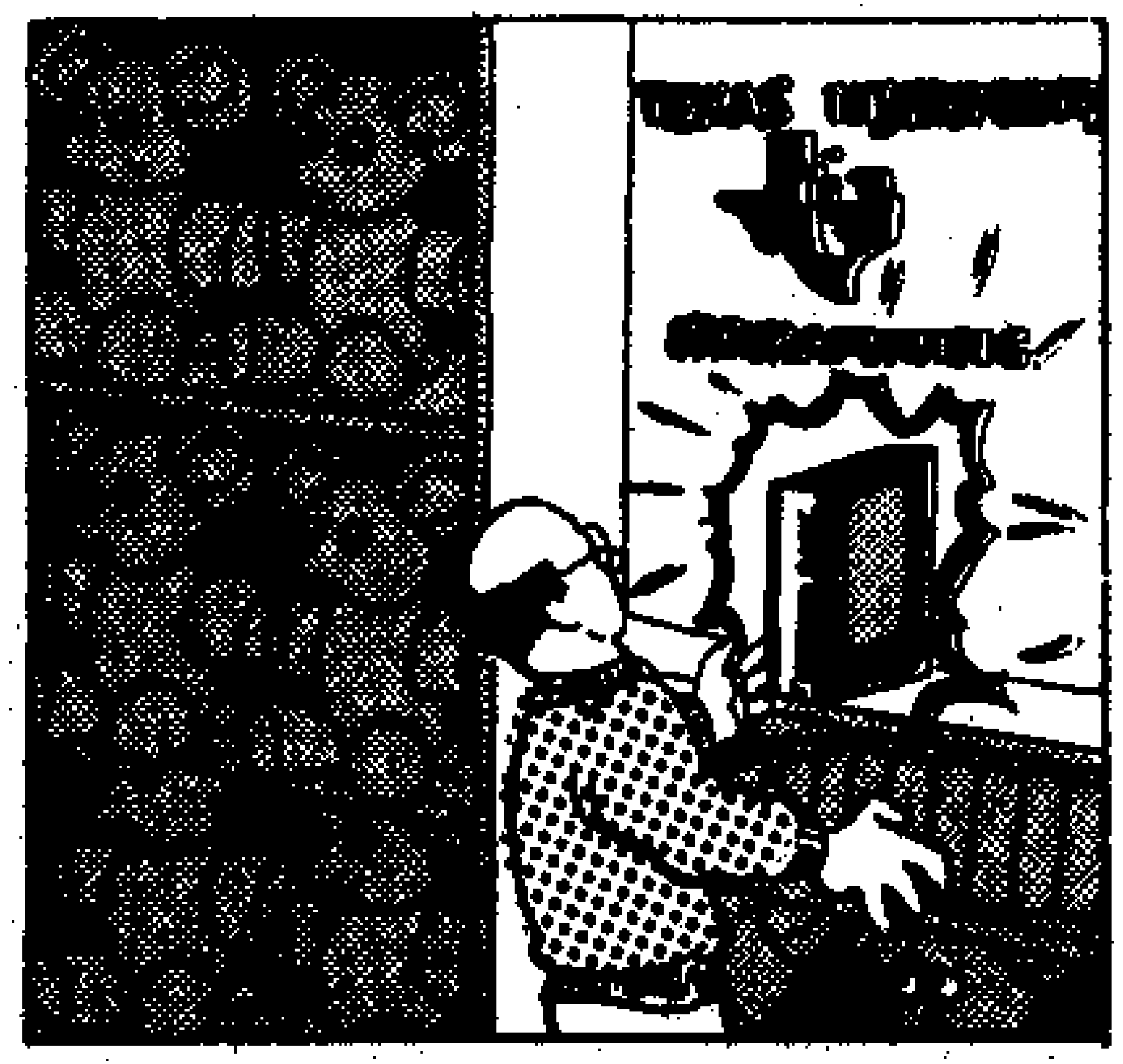
By Gregory M. Kean
18 Cleveland Lane, RD 4
Princeton, NJ 08540

I was on my way to see the movie *Star Trek: The Wrath of Khan* when I passed a Toys R Us store. Since I remembered seeing an advertisement in the paper that the store sold TI-99/4A merchandise, I decided to stop in.

To avoid wasting time, I intended to go directly to the front counter and ask if they had the Extended BASIC cartridge in stock. I had tried a number of other stores before this, always with the same response: "Sorry, it's all sold out; we expect it to arrive within two or three weeks."

Upon entering this particular store, however, I had to pass a large portion of the toy department before going anywhere else. Interesting, but still not any closer to my long-sought-after Extended BASIC . . or was I?

Suddenly, the rows of stuffed animals ended, and staring me right in the face was the home computer section. I just *had* to take a quick look for myself. So racing by the Atari and Commodore exhibits, I finally came to Texas Instruments and looked up to the shelf where the cartridges were situated. Let's see now... *Adventure, TI Invaders, Zero Zap, Tombstone City, LOGO... Extended BASIC*! I broke out into a wide grin. Finally I could use multi-statement lines! I rushed to the counter to purchase the long-awaited item. "The display is the only one left," they told me. My heart sank. "But you may purchase that one." My eyes lit up.



After buying the module for about ninety dollars after tax, I remembered the movie. Khan can wait, I decided. I'll make my own starship Enterprise at home on my computer.

Before long I was home, and tearing into my new purchase. The first thing I found was a thick reference guide which, as it turned out, proved to be remarkably easy to read. Next was the cartridge itself. Plugging it in, I pressed (2) for Extended BASIC. Suddenly, the screen changed color, and there I had it—a new language for my Home Computer!

I soon found a sample program in the manual entitled CODEBREAKER. Typing it in, I discovered a number of exciting things. Now it was possible to change the line numbers of statements without re-typing them. Also such things as DISPLAY AT and ACCEPT AT made this language more than worth the money.

Although these things are quite useful, to me they seem to be an afterthought. One word kept popping up as I skimmed through the manual—SPRITES. At the time, I had no idea what they were.

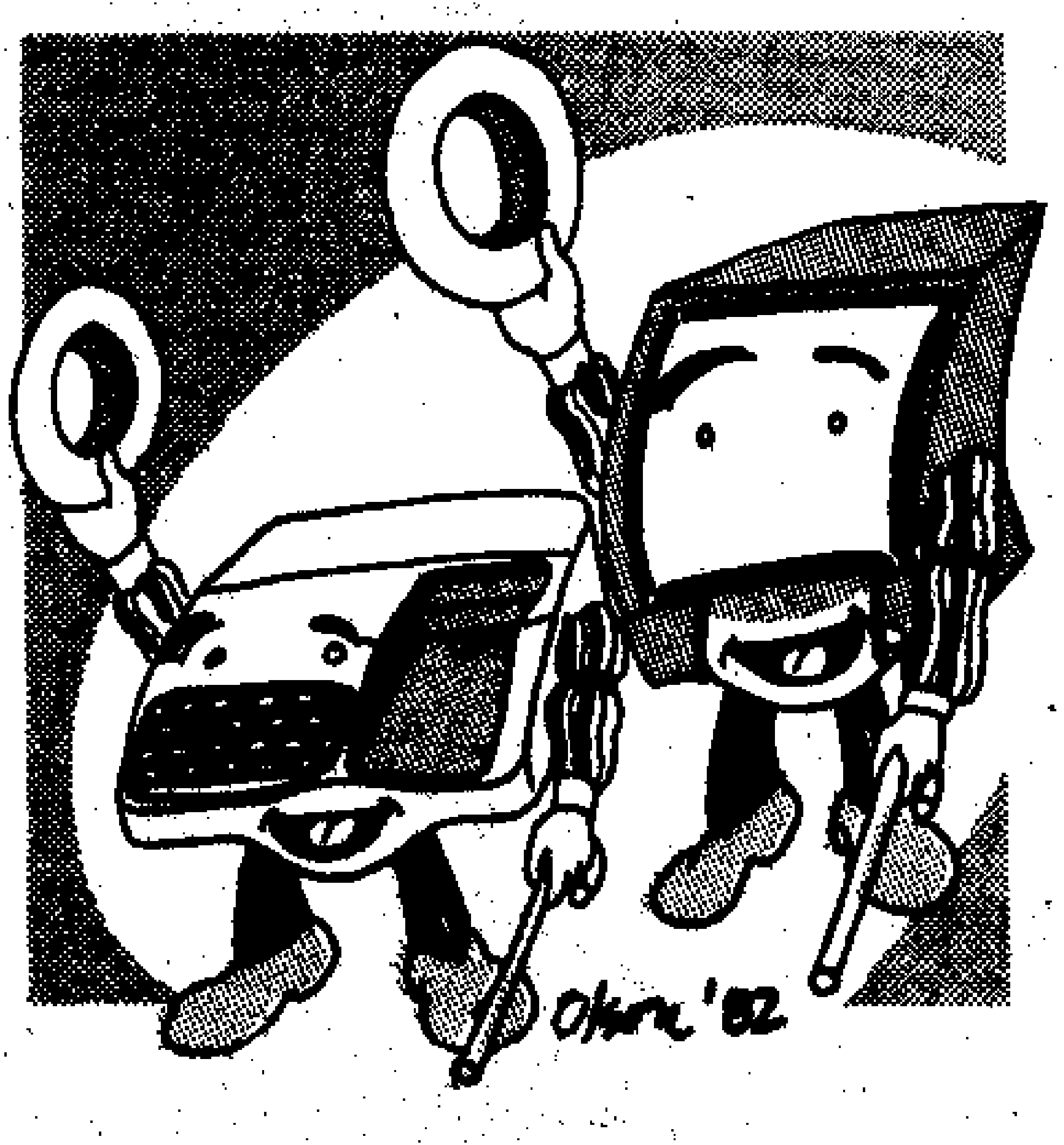
I decided that I would rather *see* what they were than read about it. So I typed in another of the sample programs that the book said made spectacular use of sprites. It was a small program—only eight lines—so it didn't take me long to type it in. I then typed RUN. You can imagine my surprise when after the screen cleared, a star appeared in the center and started to move! It moved slowly and smoothly. Then another came out from the same spot, but this one zoomed across the screen. When it reached the side, it went through from the left to the right. Sort of like ASTEROIDS, I thought. The stars kept coming until 28 of them filled the screen. All moved in different directions at different speeds.

I was grinning from ear to ear. What a surprise! It wasn't long before I typed in two more sample programs. I found another marvelous thing: sprites can be enlarged up to a size of 32 by 32 dots. I had long ago resigned myself to the fact that I would never make moving objects larger than eight by eight dots, or about a centimeter as it appears on my TV. Boy, was I wrong!

For those who are still deciding whether or not to buy this super product, I have listed below a number of the enhancements of Extended BASIC.

ACCEPT AT – This works much like INPUT, but allows data entry from just about any location on the screen. A number of options are available with this statement which makes it much more useful than the INPUT statement. The VALIDATE option allows only those characters which you have specified to be entered. BEEP makes a short beep to signal that data entry is required. ERASE ALL fills the screen with character code 32 (similar to CALL CLEAR) before asking for data entry. SIZE allows the input to be only as many characters long as specified. The only situation where INPUT may be more useful is when a prompt is required. ACCEPT AT does not allow for this, but a combination of ACCEPT AT and DISPLAY AT will do the same job.

Continued on p. 75



Subprograms in TI Extended BASIC

By Roger B. Kirchner

Contributing Editor

Subprograms in TI Extended BASIC can be the modular building blocks of good programming practice. The *subprogram* feature, which is not available in TI BASIC is quite different from the *subroutine* feature, which is available in both TI BASIC and TI Extended BASIC.

A subroutine must share the use of all variables and parameters with the main program and other subroutines. When using subroutines the programmer must be aware of *all* the variables and parameters used throughout the entire program to avoid conflicts. This often makes the finished programs hard to understand and difficult to modify.

In contrast, TI Extended BASIC allows us to define subprograms which have *local* variables and parameters (unknown to the main program and other subprograms). Communication between the main program's variables and parameters and the subprogram's *local* variables and parameters is established through the use of the CALL statement and the SUB statement.

Variables and parameters which need to be *communicated* to the subprogram are *declared* in the SUB statement. The *actual* values are passed at the time of activation in the CALL statement. All other local parameters and variables can only be referenced or modified by the subprogram itself.

Conversely, the subprogram cannot reference or modify any *external* variables and parameters that are not explicitly passed via the CALL/SUB mechanism. Subprograms may be CALLed from the main program or other subprograms (except that a subprogram must not CALL itself). This subprogram feature of TI Extended BASIC lifts the language out of the tangled world of other micro computer BASICs.

Example 1: ORACLE

To illustrate the use of subprograms in organizing a program, I translated **ORACLE** into Extended BASIC. [See *LOGO Has Style*, elsewhere in this issue—Ed.] In deference to traditional BASIC, the **HELLO**, **CONVERSE**, and **GOODBYE** procedures have been implemented as *subroutines*, but the rest have been implemented as *subprograms*.

User defined procedures **ISQUEST**, **DELAY**, and **REPLY** are called from **CONVERSE** in lines 2060,2070, and 2100. Q$ is communicated to both **ISQUEST** and **REPLY**, and YES is the output of **ISQUEST**, either −1 or 0. **DELAY** doesn't have any parameters, but it could, and would be a more useful subprogram if it did.

The parameters Q$ and YES in **CALL ISQUEST(Q$,YES)** (line 2060) are *actual* parameters. Actual parameters are those used in an activation or call of the procedure. In contrast, A$ and B in **SUB ISQUEST(A$,B)** (line 11000) are *formal* parameters. Formal parameters are those used in the declaration of a subprogram. In an activation, any reference to Q$ or YES becomes a reference to A$ or B. (Expressions can also be used as actual parameters. In this case, the value of the expression is assigned to the formal parameter.)

More subprograms are called from **REPLY**, declared in lines 12000-12130. Note how the formal parameter A$ of **REPLY** becomes an actual parameter in the activation of **ISYESNO** in 12020.

Although the use of subprograms might be overdone in this example, it is difficult to err in that direction. Read the Extended BASIC listing for **ORACLE**, and see if subprograms don't make the program easy to understand.

Example 2: MATRIX

Variables that are *subscripted* can also be passed to subprograms. **MATRIX** is a program which uses subprograms **MATINPUT**, **MATPRINT**, and **MATADD**. It accepts two matrices and prints them out, together with their sum. Studying the listing should clarify the distinction between formal and actual parameters, and the declaration and activation of a subprogram. In particular, compare the declaration heading of **MATADD** in line 12000, **SUB MATADD(N,M,A(,),B(,),C(,))**, with its activation in line 630, **CALL MATADD(R,C,U(,),V(,),W(,))**. Can you deduce the syntax for passing singly-and triply-subscripted variables to a subprogram?

The above examples are intended only to suggest how subprograms with parameters *might* be used, and to encourage their use. TI-99/4A users are very fortunate to have access to a version of BASIC which is superior to those offered on other micros. Digital Equipment Company's VAX BASIC also has subprograms, but not everyone can afford a $40,000 system . . .

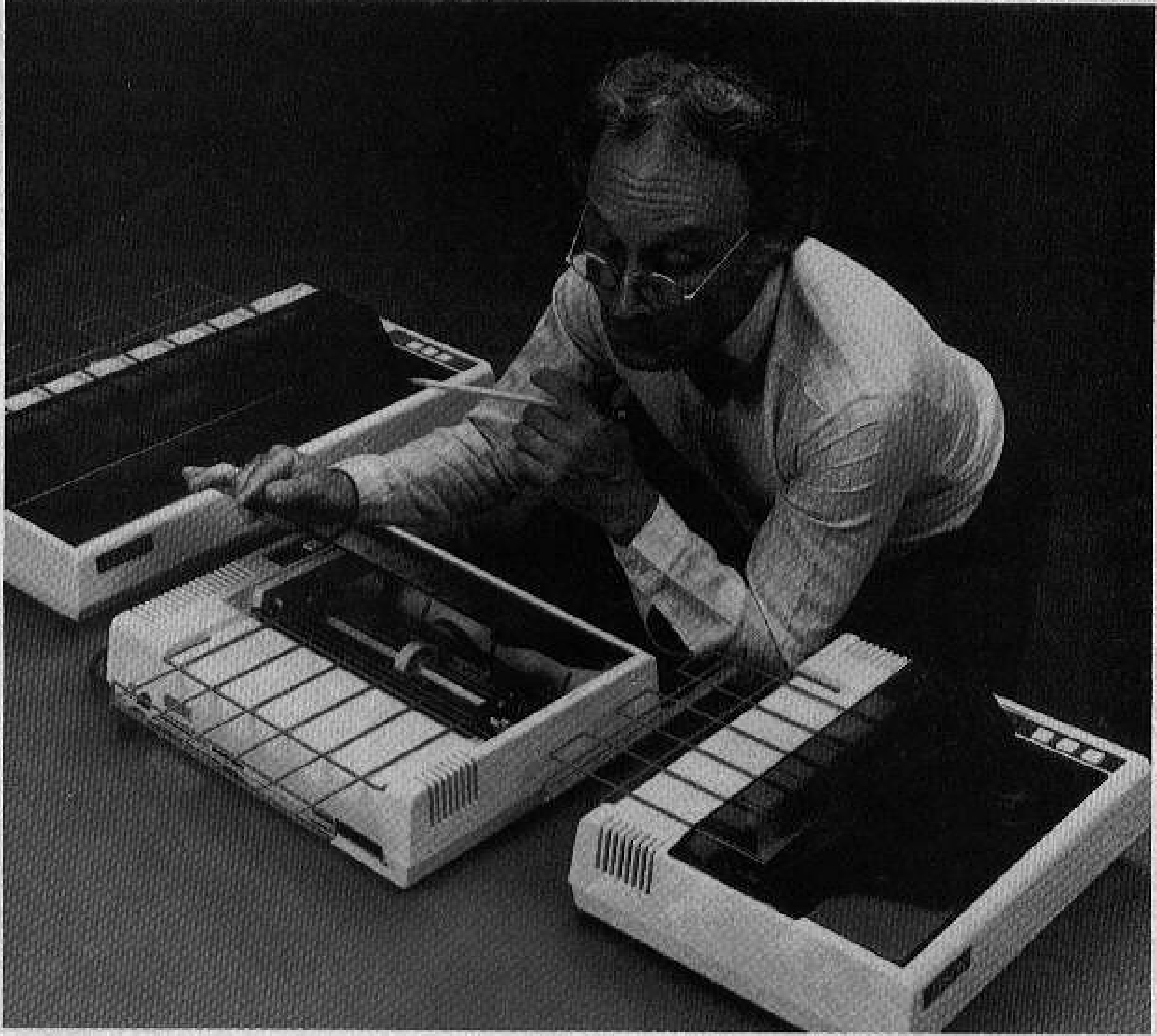
Example 1...

```
100 REM **********
110 REM * ORACLE *
120 REM **********
130 REM
140 REM BY ROGER KIRCHNER
150 REM 99'ER VERSION 2.1.1XB
160 REM
170 !
180 RANDOMIZE
190 !
500 REM BEGIN
510 !
520 GOSUB 1000 ! HELLO
530 GOSUB 2000 ! CONVERSE
540 GOSUB 3000 ! GOODBYE
550 STOP
560 !
1000 REM HELLO
1010 !
1020 CALL CLEAR
1030 DISPLAY AT(15,1):"I AM THE ORA
     CLE."
1040 DISPLAY AT(17,1):"I WILL ANSWE
     R ALL QUESTIONS."
1050 DISPLAY AT(20,1):"AFTER YOUR L
     AST QUESTION,"
1060 DISPLAY AT(21,1):"JUST PRESS E
     NTER."
1070 CALL DELAY
1080 RETURN
1090 !
2000 REM CONVERSE
2010 !
2020 PRINT :: PRINT
2030 PRINT "WHAT IS YOUR QUESTION?"
2040 LINPUT Q$
2050 IF Q$="" THEN RETURN
2060 CALL ISQUEST(Q$,YES)
2070 CALL DELAY
2080 IF YES THEN GOSUB 2100 ELSE GO
     SUB 2110
2090 GOTO 2020
2100 CALL REPLY(Q$):: RETURN
2110 PRINT "QUESTIONS END WITH A '?
     '!"
2120 RETURN
2130 !
3000 REM GOODBYE
3010 !
3020 PRINT
3030 PRINT "THANK YOU FOR CONSULTIN
     G"
3040 PRINT "THE ORACLE."
3050 RETURN
3060 !
```

Continued on p. 63

Example 2...

```
100 REM **********
110 REM * MATRIX *
120 REM **********
130 REM
140 REM BY ROGER B. KIRCHNER
150 REM 99'ER VERSION 2.1.1XB
160 REM
170 !
500 REM BEGIN
510 CALL CLEAR
520 PRINT "THIS IS A TEST OF MATINP
    UT"
530 PRINT "MATADD, AND MATPRINT."
540 PRINT
550 INPUT "HOW MANY ROWS? ":R
560 INPUT "HOW MANY COLS? ":C
570 PRINT
580 PRINT "ENTER TWO MATRICES WITH"
    :R;"ROWS AND";C;"COLUMNS."
590 PRINT "ENTER FIRST MATRIX"
600 CALL MATINPUT(R,C,U(,))
610 PRINT "ENTER THE SECOND MATRIX"
620 CALL MATINPUT(R,C,V(,))
630 CALL MATADD(R,C,U(,),V(,),W(,))
640 PRINT
650 PRINT "THE SUM OF"
660 CALL MATPRINT(R,C,U(,))
670 PRINT "AND"
680 CALL MATPRINT(R,C,V(,))
690 PRINT "IS"
700 PRINT
710 CALL MATPRINT(R,C,W(,))
720 STOP
9999 END
10000 SUB MATINPUT(N,M,A(,))
10005 !
10010 FOR I=1 TO N
10020 PRINT "ROW";I
10030 FOR J=1 TO M
10040 PRINT "(";I;",";J;")",
10050 INPUT A(I,J)
10060 NEXT J
10070 NEXT I
10080 !
10090 SUBEND
11000 SUB MATPRINT(N,M,A(,))
11005 !
11010 FOR I=1 TO N
11020 FOR J=1 TO M
11030 PRINT A(I,J);
11040 NEXT J
11050 PRINT
11060 NEXT I
11070 !
11080 SUBEND
12000 SUB MATADD(N,M,A(,),B(,),C(,)
      )
12005 !
12010 FOR I=1 TO N
12020 FOR J=1 TO M
12030 C(I,J)=A(I,J)+B(I,J)
12040 NEXT J
12050 NEXT I
12060 !
12070 SUBEND
```



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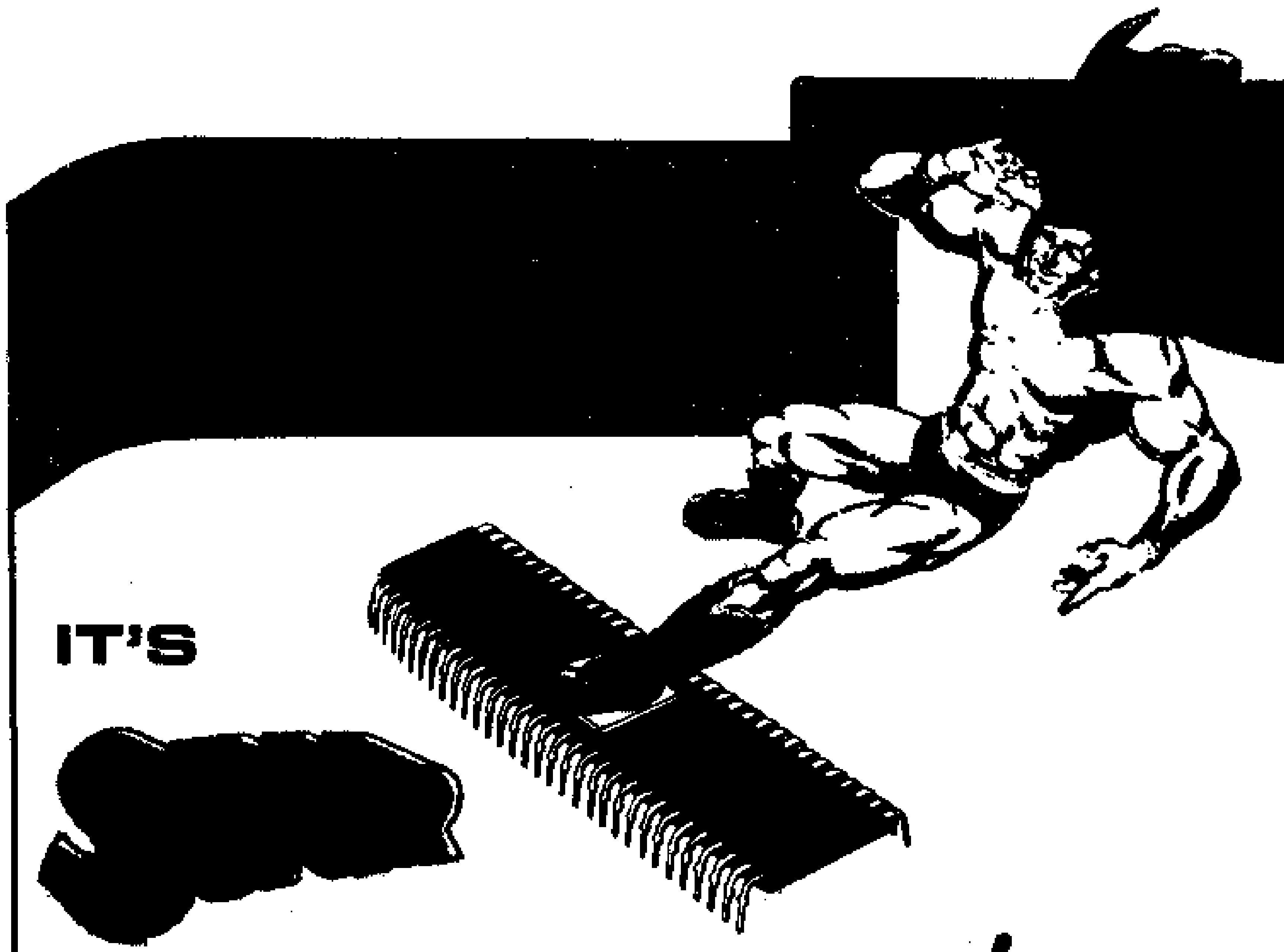

IT'S

LANGUAGE!

A Screen Dump Utility

Part 2

By Patricia Swift

Assembly Language Editor (The Human One)

This article completes the description of an Assembly Language subroutine for dumping 99/4(A) screens to the Epson MX-100, Epson MX-80, or TI-99/4 Impact Printers. The subroutine is designed to be called from TI BASIC, and can be entered into your system using either the Assembler/Editor or the Line-by-Line Assembler in the Mini-Memory Command Cartridge.

Part I of this article (in Volume 1, Number 5) presented, in detail, the main idea behind the subroutine. To recap briefly, the screen character patterns in the TI-99/4A are stored in row-wise form; that is, the first 8 bits in each 8-byte character pattern represent the dot positions in the first row of the character, the second 8 bits represent the second row, and so on. This fact is known to anyone who has used BASIC's CHAR subroutine. The Epson-type printer however, receives its bit-map information in columns of up to 8 dots, or column-wise form. It takes 8 bytes, each representing one column, to make an 8x8 dot character on the printer. If you think of each TI-99/4A character as an 8x8 matrix of dots, then the screen dump subroutine must transpose the matrix (switch rows and columns) for output to the Epson-type printer.

VDP RAM Under TI BASIC

When the TI-99/4A is under control of the BASIC interpreter, VDP RAM contains two areas of interest here. VDP RAM addresses >0000 – >02FF (0 – 767 in decimal) contain the character numbers associated with each screen position. The character patterns for character numbers 32 – 159 start at VDP RAM address >0400 (1024). The 8-byte character pattern corresponding to a character number N is 1024 + (N – 32) * 8 in decimal. (Note that the formula given in Part I of this article was slightly different. Testing has proven the formula given here to be correct.)

The dump subroutine (called DUMP) uses these facts. Starting with VDP RAM address 0, DUMP gets the screen character number and uses it to calculate the VDP RAM address of the associated character pattern. It then reads the 8-byte character pattern, transposes the matrix, and writes the resulting 8 bytes to the printer. DUMP performs this process on each successive byte of screen RAM, up to and including VDP RAM address >02FF (767).

DSRLNK and Printer Output

The actual output to the printer is done by means of a built-in Extended Utility Routine called DSRLNK. Before calling DSRLNK, the Assembly Language subroutine must set up a Peripheral Access Block (PAB) in VDP RAM. Here is the format of the PAB we'll use for the printer:

BYTE#	CONTENTS
0	I/O opcode: >00 = open >01 = close >03 = write
1	Flagbyte/status. >12 is the code for sequential file, output operation, DISPLAY type data, and variable length records.
2, 3	Data buffer address in VDP RAM. We'll use >1E00
4	Logical record length.
5	Number of characters to write.
6, 7, 8	Not used here.
9	Length of file descriptor which follows.
10 – 35	File descriptor. We'll use RS232.PA=O.DA=8.BA=9600.CR

We'll put the PAB in VDP RAM starting at address >1D00 (hereafter called V1D00), and we'll put the data area containing the actual data for output to the printer at V1E00. These addresses could have been elsewhere in VDP RAM, as long as the locations chosen were not used by something else.

To perform a printer operation, the program must do the following:

1. Build the PAB in VDP RAM.
2. Put the address of the length of the file descriptor (byte 9 of the PAB) into CPU RAM address >8356.
3. Call DSRLNK.

You'll notice that the call to DSRLNK must be followed by a word (two bytes) containing the value 8, which means that you want to link to a Device Service Routine (DSR).

RS232 Considerations

Since the DUMP subroutine uses the RS232 interface to communicate with the printer, some additional code is needed to save and restore the address of the GROM. This is because the GROM address is changed when the RS232 DSR is used. At the beginning of the DUMP subroutine, the GROM address is obtained one byte at a time from the GROM Read Address at location >9802. The GROM address increments itself when the first byte is read (actually moved) from the GROM Read Address. This makes the second byte of the GROM address one too big, so it must be decremented by DUMP. Just before

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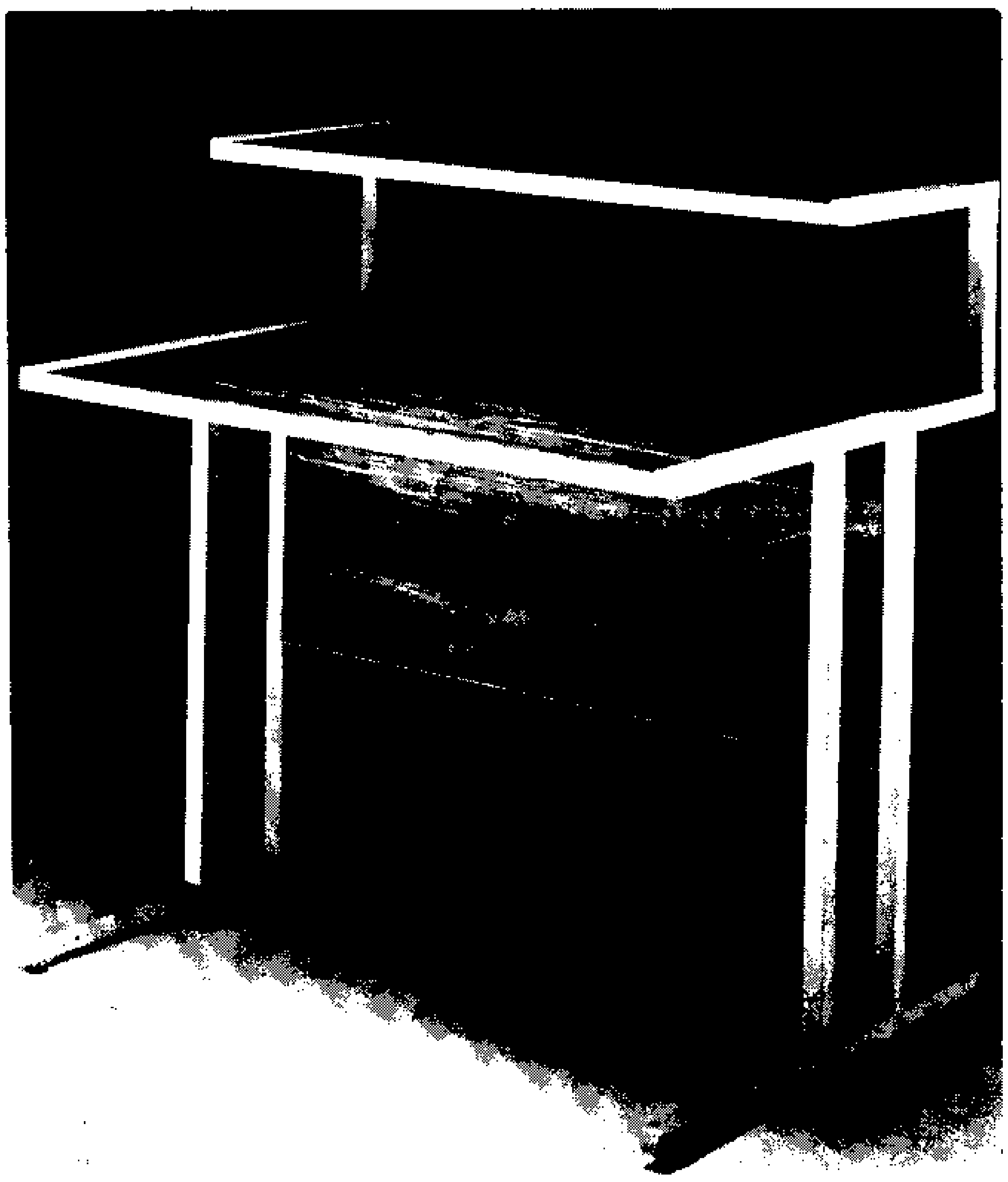

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returning to BASIC, the DUMP subroutine restores the GROM address by moving it to the GROM Write Address at location >9C02, again one byte at a time.

Linkage to TI BASIC

A TI BASIC program invokes the DUMP subroutine by the statement CALL LINK("DUMP"). DUMP returns to the BASIC program by branching to the contents of register 11 (R11). Just before returning to BASIC, the DUMP subroutine clears the error byte at @>837C (sets it to 0). Failure to clear this byte can result in an undeserved INCORRECT STATEMENT error when you return to BASIC.

Transposing the 8x8 Character Matrix

Once a screen character's 8-byte pattern has been read into CPU RAM at label IN (of the program listing), the DUMP subroutine uses the following technique to build the 8 bytes of output at label DO.

The first byte of DO is composed of the first bit of each of the 8 bytes starting at IN, the second byte of DO is composed of each second bit of the bytes at IN, and so on. Figure 1 shows the bit movements for the character pattern "A".

Figure 1 is just Figure 3 from Part I, with the input data labeled IN and the output data labeled DO.

DO is built from left to right, and R4 is used to hold each byte of DO as it is built. R4 is cleared before each byte is built, so DUMP has to turn on any bits necessary.

To tell if a certain bit of IN is on, DUMP compares the value of the byte containing the bit in question to a power of 2. To see how this works, consider the byte containing >82 (130 in decimal, 1000 0010 in binary). The leftmost bit of the byte is on; in fact, the leftmost bit would be on in any byte containing >80 (128) through >FF (255). In other words, we could test for the leftmost bit being on by comparing the value of the byte to decimal 128 (2 to the 7th power); if the value is less than 128, we wouldn't have to turn on the corresponding output bit.

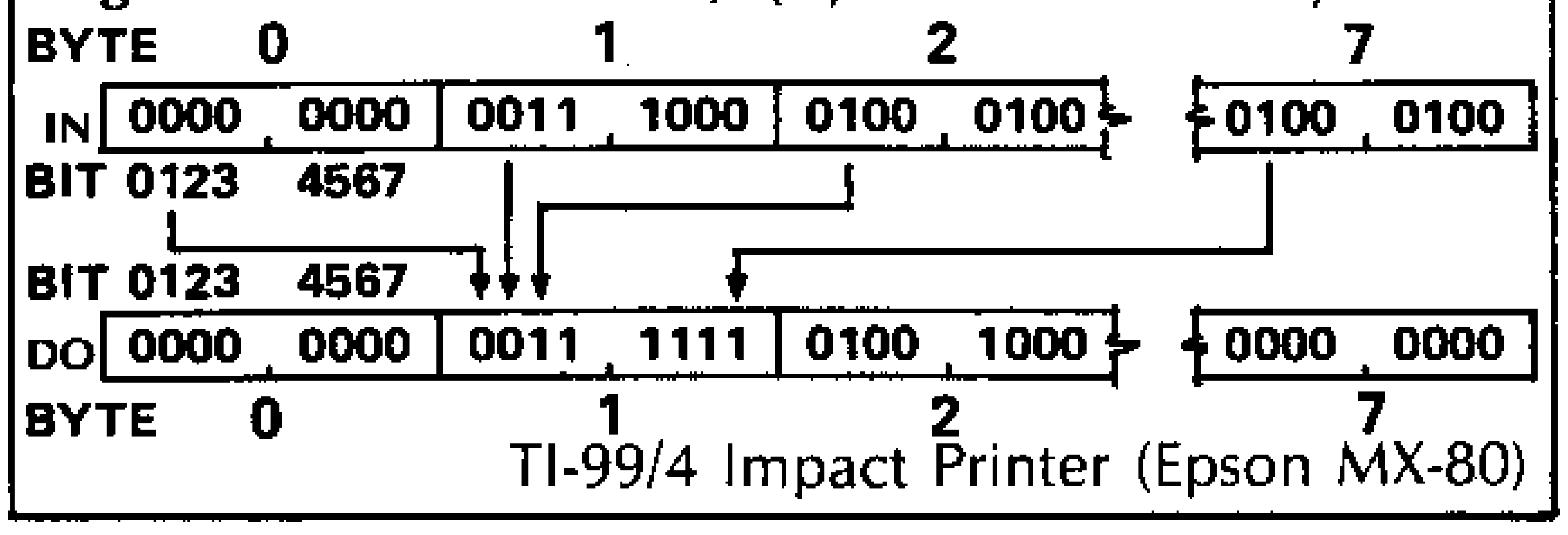
For our purposes, we can use this technique to test any bit of a byte by using the appropriate power of 2. The second-to-leftmost bit can be tested against 64, its neighbor to the right against 32, and so on down to 1 for the rightmost bit. This works because we'll be considering the bits from left to right in each byte. After each bit is tested, it must be turned off (in CPU RAM, not on the screen) so that it doesn't interfere with the test of the following bit. To see this, consider again the byte containing >82 (130). If we want to determine if the second-to-leftmost bit is on, we would compare the byte to 64. You can see that it would pass the test, even though the bit in question is not on! However, if we had reset the leftmost bit to 0 after testing it previously, the byte would now contain >02 instead of >82, and the test would fail as it should.

Once we have decided that an input bit is on, we must set the corresponding bit in R4 to on. This is done by adding the appropriate power of 2 to R4. To turn on the leftmost bit, add 128; to turn on the rightmost bit, add 1. Remember that the byte being built is in the right half (LSB, or least significant byte) of R4.

DUMP uses R5 to contain the power of 2 for testing whether the input bit is on, and R6 to contain the power

Continued on p. 24

Figure 1.


TI-99/4(A) character in binary form:
BYTE 0 1 2 7
IN 0000 0000 0011 1000 0100 0100 0100 0100
BIT 0123 4567
BIT 0123 4567
DO 0000 0000 0011 1111 0100 1000 0000 0000
BYTE 0 1 2 7
TI-99/4 Impact Printer (Epson MX-80)

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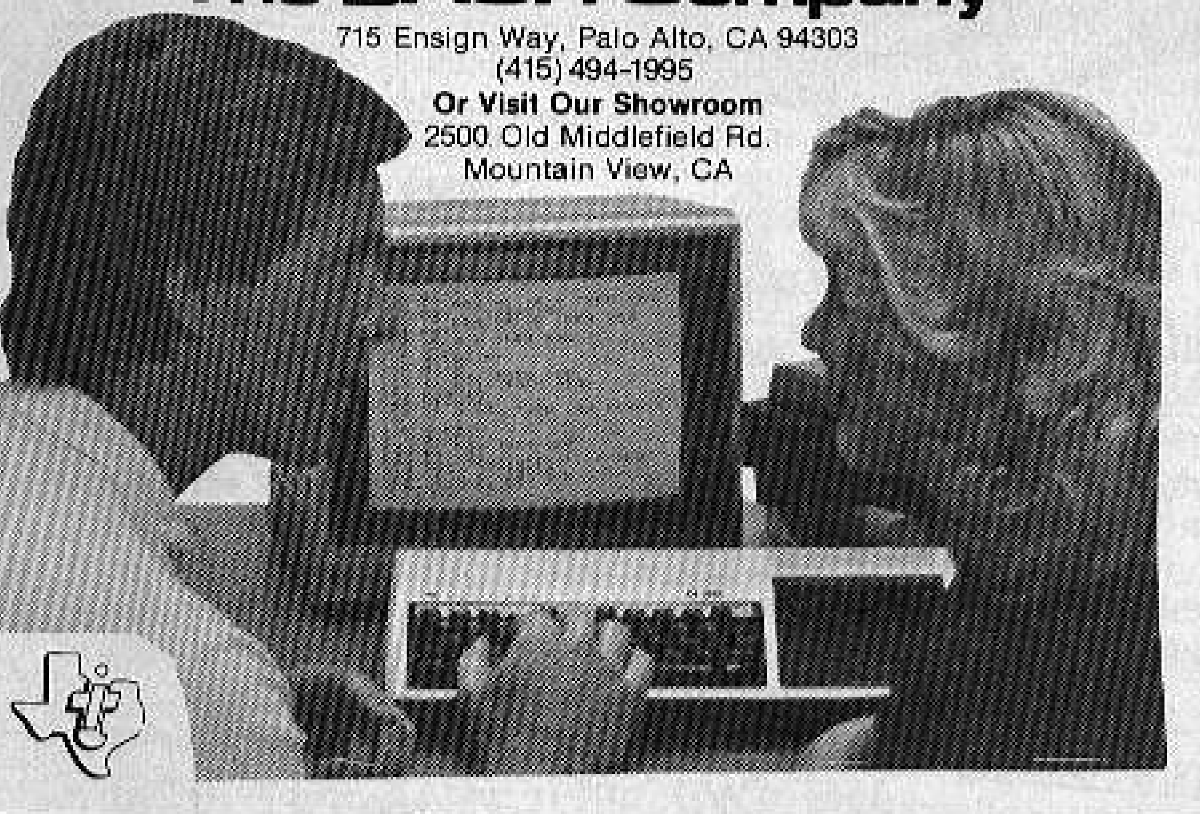


Letters . . . from p. 7

Dear Sir:

I spent hours working on a game using the old Extended BASIC module (one of the first ones distributed) and my first TI-99/4A console. The game used sprites and it was important not to let the sprites "wrap"—they were to disappear at the edge of the screen. You can imagine my dismay when a friend tried the game on his TI-99/4 console and sprites were wrapping, causing all kinds of bugs.

Regena's Examples

Time in seconds (three trials) Process	New XBASIC New Console	Old XBASIC New Console	New XBASIC Old Console	Old XBASIC Old Console
100 FOR I=1 TO 10000 110 NEXT I	39.97 39.90 39.90	73.58 73.53 73.60	40.10 40.18 40.03	73.57 73.66 73.60
100 FOR I=1 TO 10000 ::NEXT I	35.90 35.98 36.03	66.28 66.20 66.23	36.20 36.08 36.22	66.33 66.37 66.40
100 FOR I=1 TO 100 110 PRINT I 120 NEXT I	10.24 10.27 10.25	15.15 15.07 15.08	10.50 10.61 10.59	15.06 15.09 15.06
100 FOR I=1 TO 100 ::PRINT I::NEXT I	10.58 10.46 10.62	15.00 14.95 15.08	10.57 10.60 10.60	15.29 15.10 15.10

I have since discovered that the newer TI-99/4A consoles operate differently than the first TI-99/4A consoles. The new Extended BASIC modules are faster than the old ones. Any game written in Extended BASIC that is dependent on critical timing may need adjustments for different combinations of new and old consoles and new and old modules. Below are some examples:

Regena
?,?

Thanks, Regena—wherever you are . . .

Dear Sir:

I have just received my first copy of your fabulous 99'er Magazine. I love the game listings that you publish.

I am an owner of a TI-99/4A console. If it wouldn't be any trouble, could you tell me where I could obtain a schematic for the TI-99/4A. I tried the Texas Instruments Consumer Relations Dept. and I haven't gotten a reply.

Again your magazine is the greatest.

Trevor Gyles
Boxford, MA

Texas Instruments has informed us, Trevor, that the technical manual for the TI-99/4A is currently available for $15.00 plus $2.00 shipping and handling from:

Texas Instruments
Dealer Parts Dept.
P. O. Box 10508
Lubbock, TX 79408

For those readers living in Texas who order the manual, include state sales tax.

Dear Sir:

I just recently acquired an Epson MX-80 Printer for use with my TI-99/4 computer. I am having extreme difficulty in using the MX-80 printer since the manual that came with it seems to have been prepared for TRS-80 users in mind only.

Would you know if there is a manual just for use with the TI-99/4 or are there other printed materials or magazine articles that could help guide me in the proper use of the printer with my TI-99/4.

Carlos C. Torres
Makati, Metro Manila, Philippines

TI now sells a fully configured MX-80 printer known as the TI-99/4 Impact Printer (PHP2500) and includes a very good manual with it—written especially for TI-99/4A owners. At this time, Texas Instruments doesn't offer the manual separately, but when we asked them about it, a spokesman said ". . . sounds like a good idea . . . we'll give it some thought." Since there are lots of MX-80 owners that have asked about a manual of this type, 99'er Magazine will publish the pricing and order information when and if TI releases it. In the meantime, watch for forthcoming issues for a new series on how to use this (now TI) printer with your Home Computer.

Dear Sir,

In Vol. 1, No. 2 a reader asked for help in writing a program which would incorporate high-resolution plotting in scientific graphs.

In particular I would like to have a program which would do something simple, like plotting a perfect circle in the center of the screen, plotting a line at some angle other than 45 degrees, or constructing a sine wave with high resolution.

Would it be possible to do this with the aid of the Mini-Memory Module?

Can the TI-99/4 computer be modified to match the TI-99/4A's graphics resolution? If so, how?

W. Calvin Moore
York, PA

As this issue goes to press, the finishing touches are being put on a super article to appear in the December 99'er. This article will describe a program to do just what you are talking about. Yes, Calvin, the old TI-99/4 can be modified—the secret will be contained in the very same article. And that's not all. If you have just purchased a Mini-Memory cartridge, you will be most impressed with what we have in store for you . . .

Dear Sir,

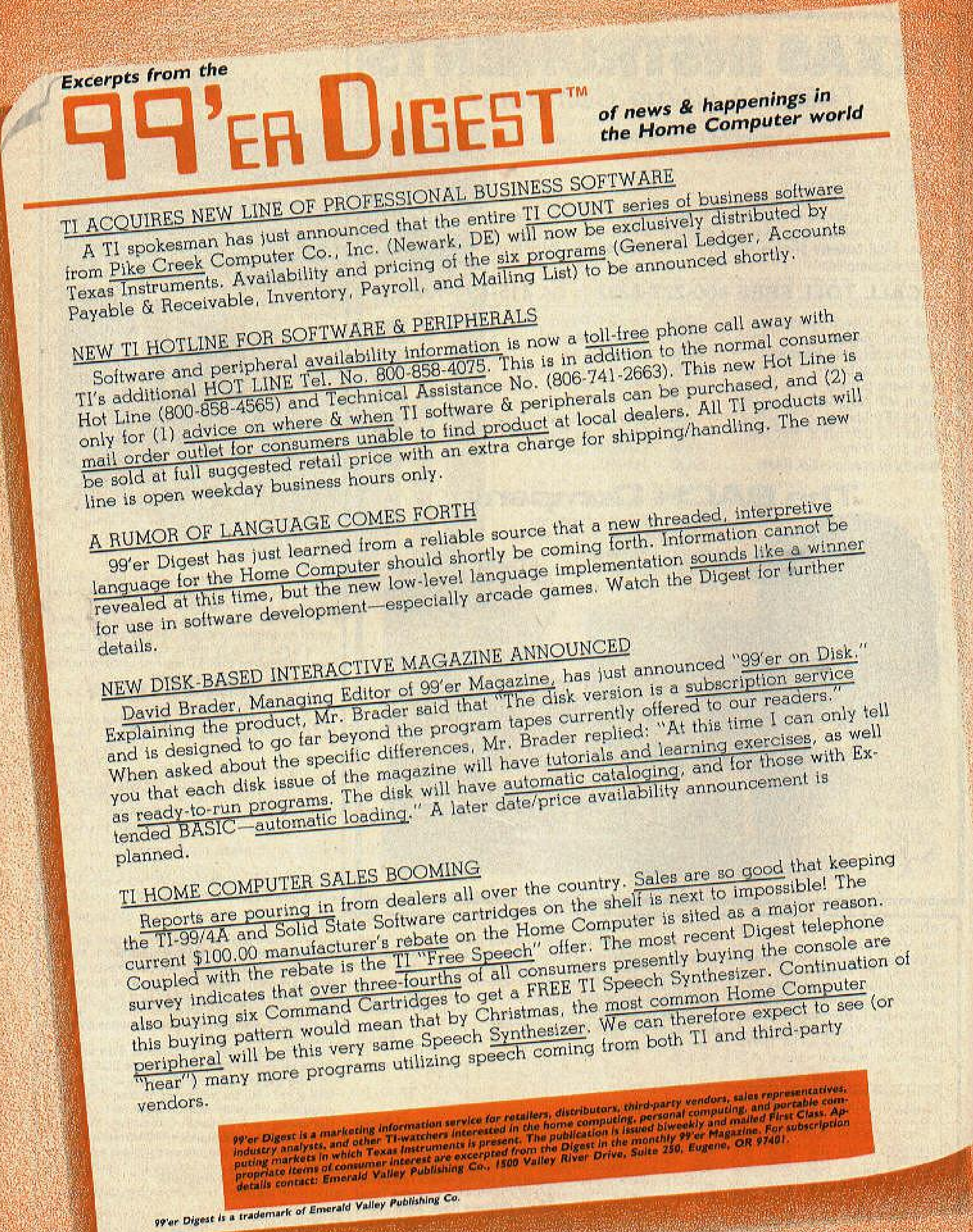
My husband and I have literally "slurped up" the valuable information the 99'er has offered. As new owners (only six weeks), we have received and studied all your issues. I must say that the educational software was the sellling tool that swung us from the Vic 20. We have four children, ages 8, 6, 4, 2, and they are a principal reason in our purchase decision.

I'm impressed with LOGO Times and can't wait till we're able to purchase our own LOGO. Can you also present an in-depth review of the PILOT language? I vote for you to go monthly since your publication is better than Compute, Byte, Popular Computing and Personal Computing. We have canceled other subscriptions in favor of the 99'er.

This is the first time I've ever written a magazine publication and it's only because I'm impresed with the 99/4A and your magazine.

Cindy Eckhardt
Palatka, FL

Start watching for our PILOT coverage to really take off, Cindy, as we are just now starting to flex our wings.



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A TI spokesman has just announced that the entire TI COUNT series of business software from Pike Creek Computer Co., Inc. (Newark, DE) will now be exclusively distributed by Texas Instruments. Availability and pricing of the six programs (General Ledger, Accounts Payable & Receivable, Inventory, Payroll, and Mailing List) to be announced shortly.

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A RUMOR OF LANGUAGE COMES FORTH

99'er Digest has just learned from a reliable source that a new threaded, interpretive language for the Home Computer should shortly be coming forth. Information cannot be revealed at this time, but the new low-level language implementation sounds like a winner for use in software development—especially arcade games. Watch the Digest for further details.

NEW DISK-BASED INTERACTIVE MAGAZINE ANNOUNCED

David Brader, Managing Editor of 99'er Magazine, has just announced "99'er on Disk." Explaining the product, Mr. Brader said that "The disk version is a subscription service and is designed to go far beyond the program tapes currently offered to our readers." When asked about the specific differences, Mr. Brader replied: "At this time I can only tell you that each disk issue of the magazine will have tutorials and learning exercises, as well as ready-to-run programs. The disk will have automatic cataloging, and for those with Extended BASIC—automatic loading." A later date/price availability announcement is planned.

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Reports are pouring in from dealers all over the country. Sales are so good that keeping the TI-99/4A and Solid State Software cartridges on the shelf is next to impossible! The current $100.00 manufacturer's rebate on the Home Computer is sited as a major reason. Coupled with the rebate is the TI "Free Speech" offer. The most recent Digest telephone survey indicates that over three-fourths of all consumers presently buying the console are also buying six Command Cartridges to get a FREE TI Speech Synthesizer. Continuation of this buying pattern would mean that by Christmas, the most common Home Computer peripheral will be this very same Speech Synthesizer. We can therefore expect to see (or "hear") many more programs utilizing speech coming from both TI and third-party vendors.

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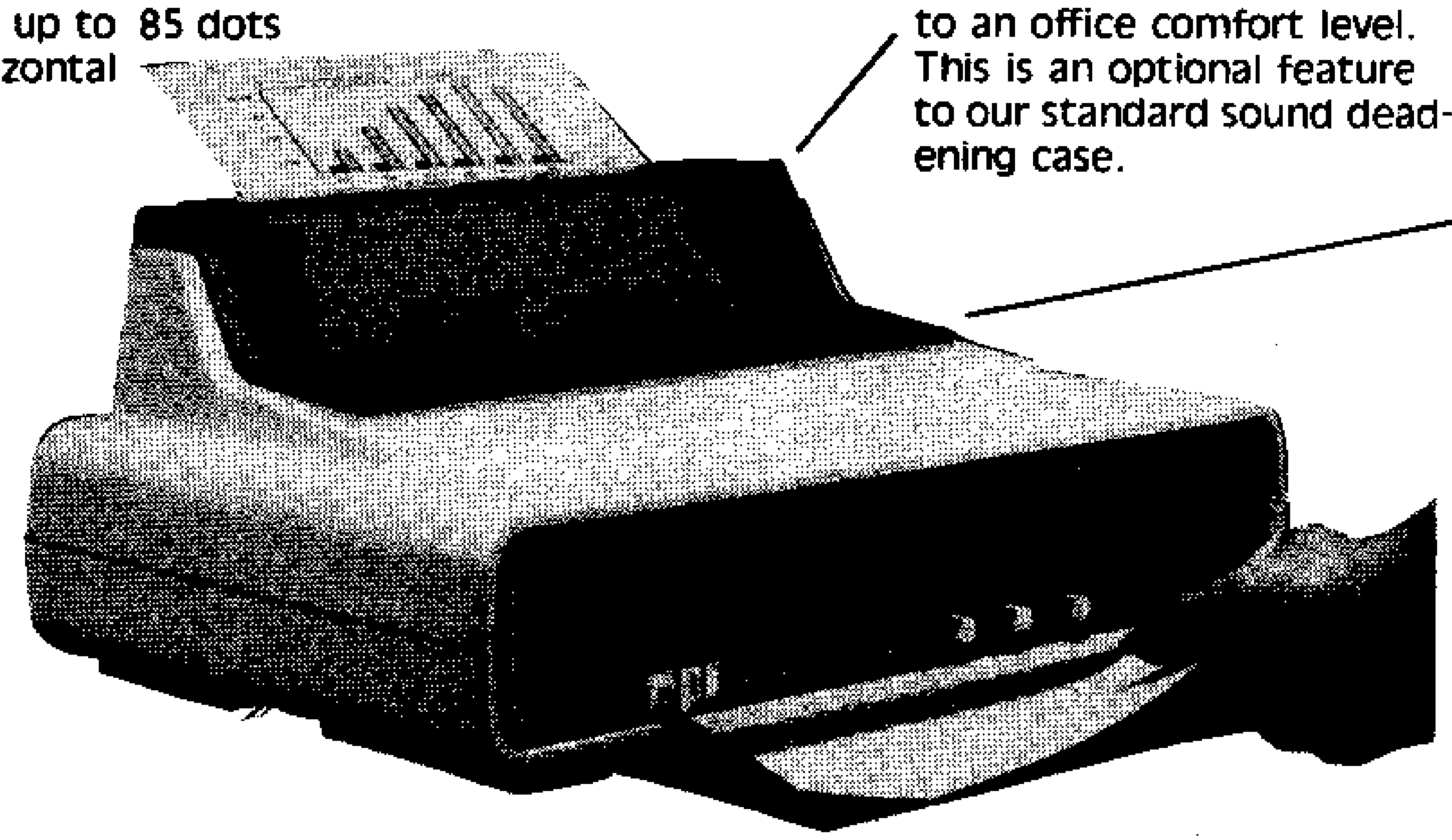

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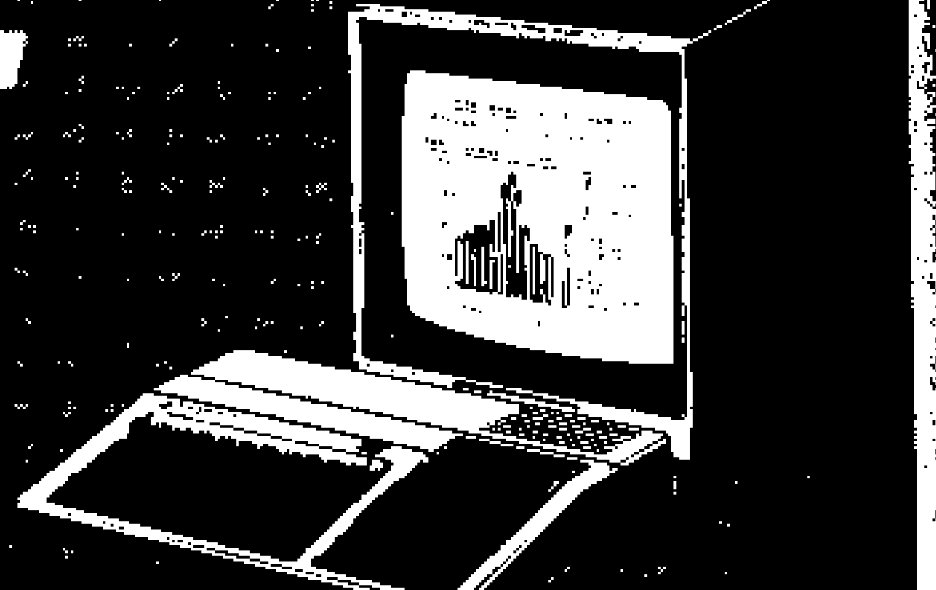

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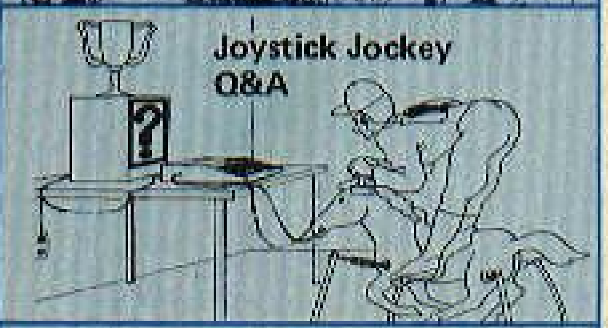
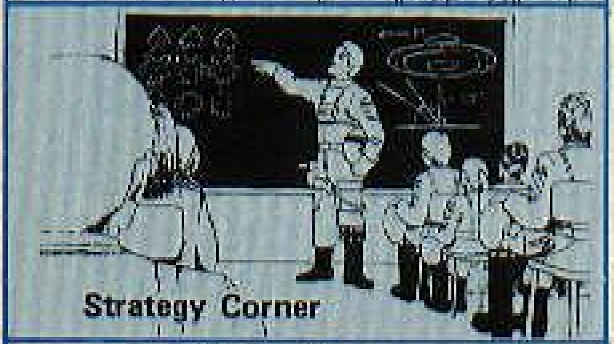
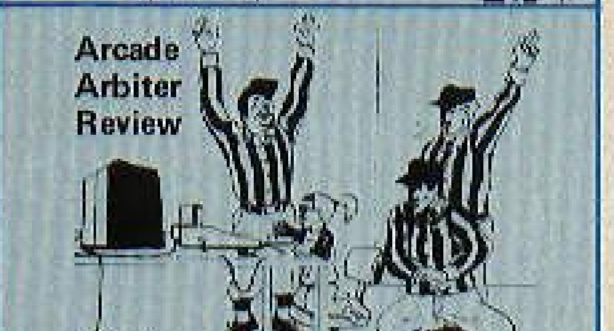
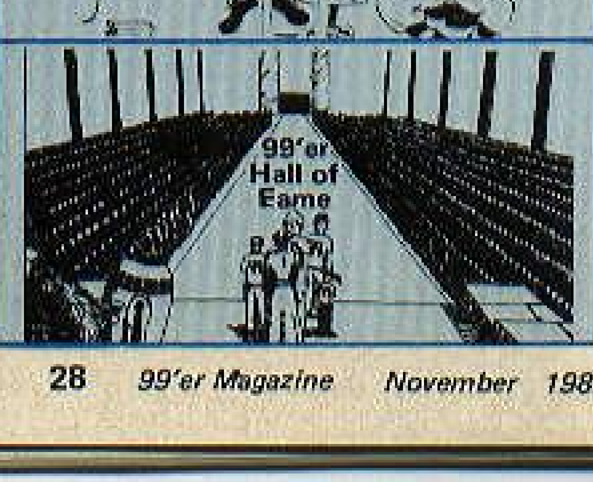








Adventure Registry

Adventure Registry

PHARAOH'S TOMB

An Adventure Successfully Completed

By Steve Schwartz
Game Review Editor

Trap doors that open beneath you, violent ghosts that unexpectedly attack you, walls that entomb you alive—these are some of the *fun* things that await you in *The Pharaoh's Tomb*, a new graphic "treasure hunt" game from Millers Graphics.

It's an extremely challenging game—almost *too* difficult—but it's a definite ordeal tearing yourself away from it once you've begun. What you're trying to do is gather treasures. Since you have an overhead view of the entire tomb, it's very easy to see where they're at. What you *can't* see, however, are all the trap doors that spring open when you step on them (hurtling one of your five "men" to an untimely death, with a *very* impressive sound effect, I might add). Since the trap doors do not move around during the game, you'll have to remember where they're at to avoid making the same mistake twice.

Does a wall stand in your way? No problem—just drill through it by pressing the arrow key in the direction of the wall. Sometimes, though, a ghost hears the drill and attacks. Then you've got problems! Move quickly and you're safe, but he who hesitates is lost.

Once you've collected 10 treasures, you'll progress to the next level of difficulty. More treasures await you, at each level, as well as an increasingly aggressive ghost. With each level you conquer, you'll be rewarded with another man.

As I previously mentioned, *Pharaoh's Tomb* is a very difficult game, so you're not likely to tire of it quickly. On the other hand, if you tend to get frustrated easily, this may not be the game for you.

Some of the best sound effects I've ever heard are incorporated into this game, and a *gorgeous* graphic display is presented while the program is initializing. (Unbelievably, this impressive graphic display uses up only one line of the program!)

According to the author o the game, there is a secr way to make all of the tra doors become visible—a te rific way of getting to th higher levels. Unfortunatel he wouldn't tell me the secre so I guess I'm stuck with onl being able to get to th third level!

Don't be afraid to ent *The Pharaoh's Tomb*—it's lot of fun getting yourse killed!

The Pharaoh's Tomb b Craig Miller is available i Extended BASIC for $14.9 on cassette, $17.95 on disk through Millers Graphics, 147 W. Cypress Ave., San Dima CA 91773.

TUNNELS OF DOOM

An Adventure Successfully Completed

By Roberta Knoblauch
231 E. Church St.
Lewisville, TX 75067

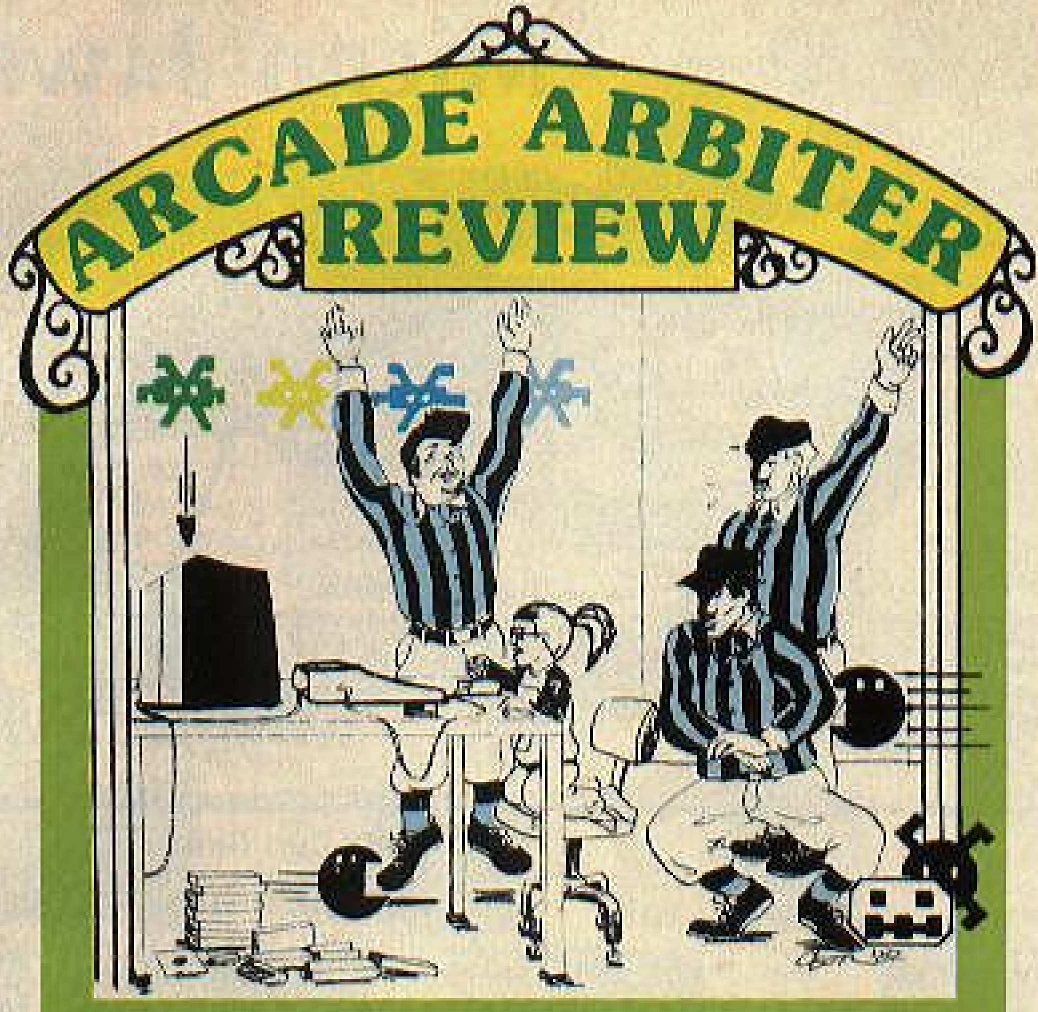
I'm three floors below ground level—a sword in one hand, with a bow and arrows on my back. My armor is still holding up, but my shield is in poor shape after being sandblasted by the Dust Devils I just fought. I won that battle, though, earning two magic scrolls and a drink from a healing fountain. Should I stay on this level a bit longer, gaining more experience and treasure, or should I descend to the fourth floor, where still more fearsome creatures lurk? The King, trapped in an airtight vault somewhere on that floor, is running out of time. . .

Tunnels of Doom, the new fantasy-adventure game from Texas Instruments, is a definite MUST for any daring dungeon explorer. Like the Scott Adam's *Adventures*, it too is a series. You must first buy the Command Cartridge, which comes complete with two games on disk or cassette. More game disks and tapes are promised for the future. Also, like *Adventure*, you can save a half-completed game and return to it later.

Unlike *Adventure*, this is a graphics game, with a minimum of typing, and *that* makes all the difference. As you walk along the dungeon corridors, three-dimensional graphics give you a real feeling of motion. Doors and side passages appear in the distance, come nearer and nearer, and disappear behind you. O if you wish, you can turn t the side to open a door o look down that mysterio passage. You map the area you see, but cannot move t a lower level until you hav found a complete map of th level you are on.

The 3-D graphics switch t a 2-D overhead view whe ever you enter a room. Th allows you to see the roo and its contents clearl which is vital when some o the contents are monster By "killing" the vicious crea tures, you can win the treas ures they guard. Treasur

Continued on p. 4



RING DESTROYER

Reviewed by D. G. Brader

Author:	**Paul Kugler & Steve Meyers**
Program Type:	**Arcade "Asteroids Type"**
Language:	**Extended BASIC or Assembly**
Distributor:	**Republic Software** **P. O. Box 23042** **L'Enfant Plaza** **Washington, DC 20024**
Price:	**$19.95, cassette or disk**

Message to the scout ship squadron leader—"Aliens have invaded the Solar System! Massing their forces in the Rings of Saturn, they have already raided and destroyed a number of outposts on Saturn's satellites, and the attacks are spreading. Your mission is to penetrate the rings and destroy any ring fragments large enough to interfere with our main invading forces. Caution, it is probable that enemy ships will attempt to harass you, but permission is granted to destroy them. Good luck, Commander . . ."

The preceeding dialog sets the scenario for *Ring Destroyer*, an arcade-style game from Republic Software.

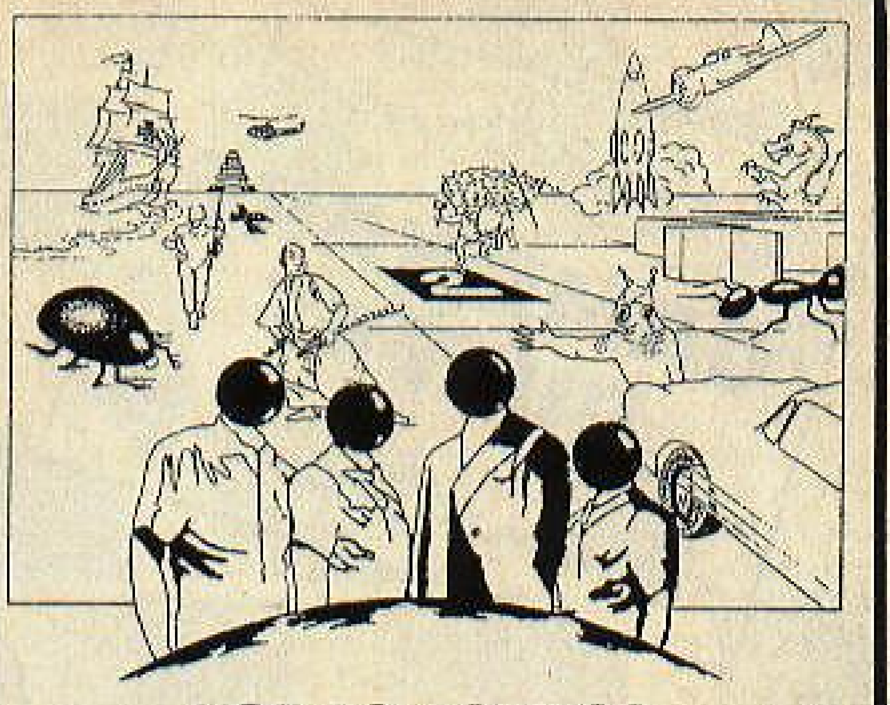
This game really impressed me the first time I played it. The screen turned black and a beautiful graphic presentation of Saturn and its rings appeared. There was simulated motion in the rings and a space craft was shown moving from the foreground toward Saturn. As the spacecraft approached the planet, it decreased in size to give the feeling of traveling a great distance. I got a kick out of restarting the game several times just to admire this simulation!

You are given 3 ships to start the game; the first is placed in the center of the screen. The current total of points scored is displayed in the right-hand upper corner. The number of points scored on a particular hit is determined by what is destroyed. Small ring fragments score less than large ring fragments; enemy ships, logically enough, are worth the most.

During play, moving the joystick to the left rotates your ship counterclockwise. Moving the stick to the right rotates the ship clockwise. Pushing the stick forward applies acceleration in the direction your ship is pointed. Just as with a real spaceship, you must rotate and decelerate to slow down. Pulling the stick back sends your ship into *hyperspace* and brings it back at a random location on the screen. Pressing the fire button launches a torpedo from the ship's nose.

Ring Destroyer is delivered with two language versions resident on the media. The first is

Continued on p. 43



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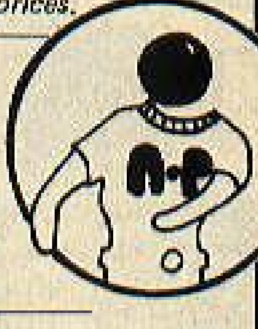

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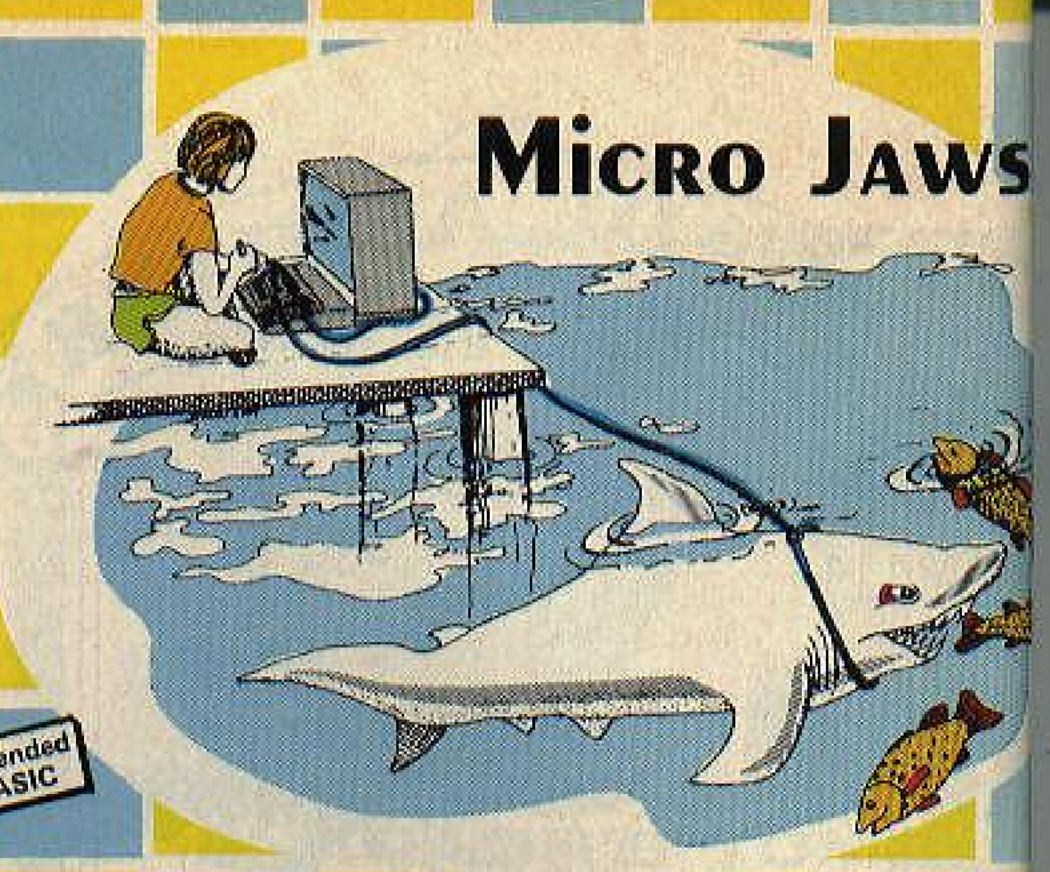
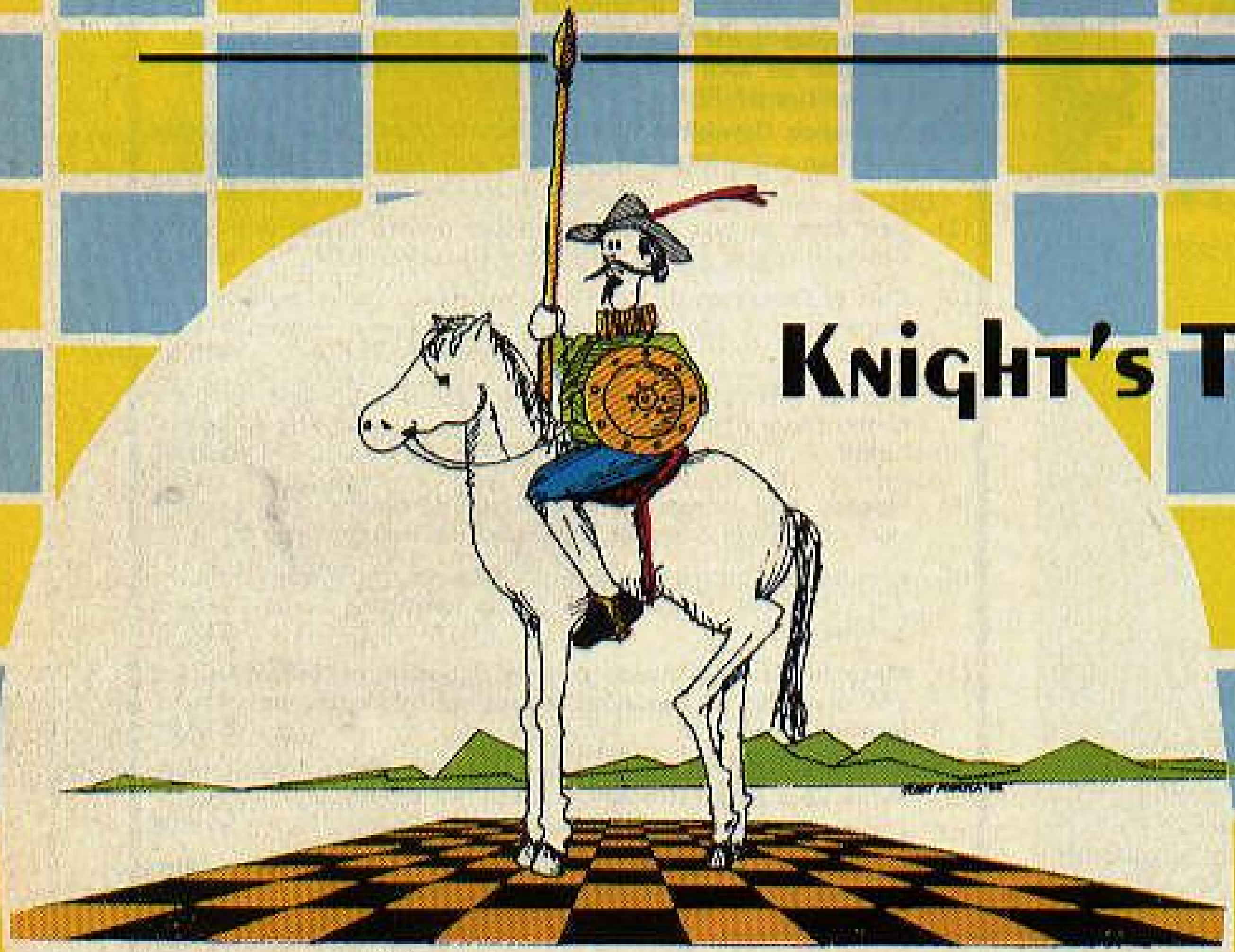


Extended BASIC



KNIGHT'S TOUR

By Curt Garcia
10202 Forum Park Dr. Apt 310
Houston, Texas 77036

The dusty old knight squint across the checkered landscap Was that another giant ov there or just a windmill in his mind . Only 17 more locations in his twisti journey. Will he give up before sol ing the puzzle? Who will guide hi through the challenge of the *Knigh Tour* . . .

To win, the player must visit all positions on the chess board on *once*, using standard chess rules. Th is one of the best logical puzzles wr ten in TI BASIC that we have see Two worthwhile notes: When usi this program on the TI-99/4A, mak sure that the "Alpha Lock" key depressed. And, to move the knigh first enter the *row* number and th the *column* letter—e.g., 4A.

Once you have entered the pr gram, save it on tape or disk. The

TI BASIC

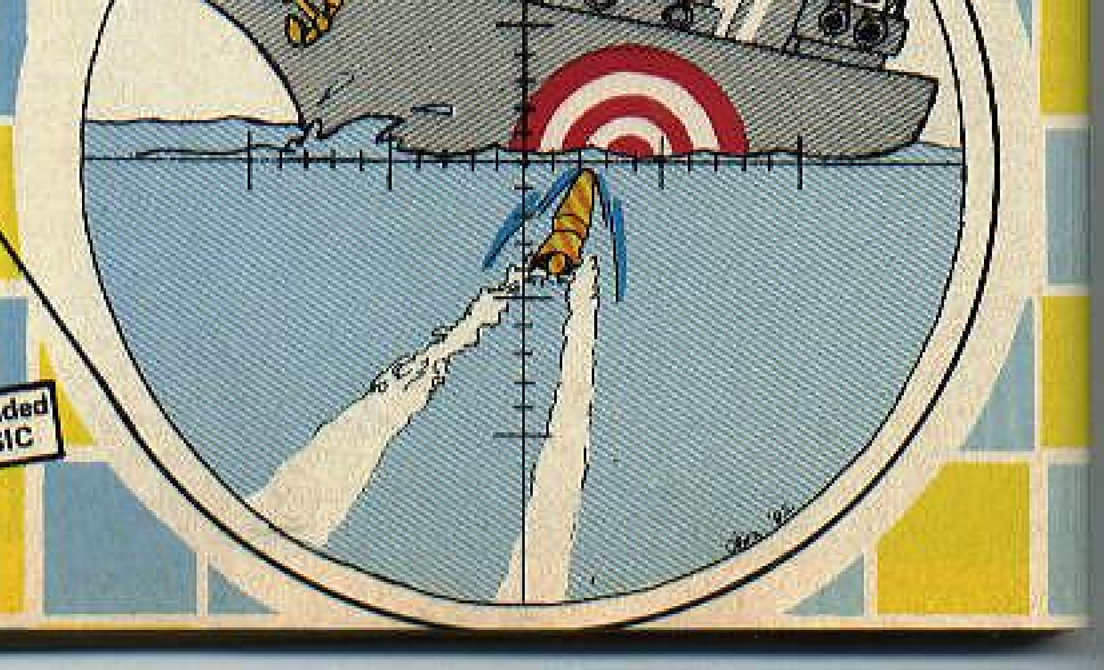
"Up Scope"

By James R. Dew
4050 Shoreline Drive
Robbinsdale, MN 55422

The crew sweats as the periscope breaks water . . There's something up there, but what? In seconds, you see the awesome answer—an enemy destroyer bearing down on you at flank speed. You have only *two* torpedoes left! Are they enough to sink your adversary, or should you dive and risk the depth charges? Only seconds remain to decide, as the deadly destroyer comes closer . .

The *Up Scope!* program uses the TI-99/4A and Extended BASIC to chart a demanding and colorful course for

Extended BASIC



By Samuel D. Pincus
Contributing Editor

Being a Great White Shark is not easy. For some unknown reason, fish just don't want to be eaten. But the Great White must eat everything in sight or die of hunger.

The *Micro Jaws* program is written in Extended BASIC, and offers the shark a feast of five fish which must be consumed within 150 time units. The program follows the small arcade-style game format using many sprites. The potential for high-speed motion across all screen quadrants makes this an intriguing Home Computer game.

Using the four keys, S, E, D, and X, you manuever up or down and control your swimming speed as your prey attempt to elude your massive *Micro Jaws*. To eat a fish, you must come up directly behind and swim over it until the fish fits inside your eager jaws.

It is possible for you to miss what looks like a perfect "fish gobble" because of the difficulty in checking for sprite coincidences [a characteristic of the Extended BASIC language—Ed.]. Conversely, sometimes you get credit for a gobble even though you may seem to just miss getting the fish into your jaws. All in all, these two possibilities seem to cancel each other out.

There are two things you must keep in mind. First, a fish can go up or down off the screen and will reappear at the other side. The shark, however cannot go all the way to the top or all the way to the bottom. This makes it possible for a fish to escape what looks like certain death. Second, as the shark moves up or down, he will scare some of the fish into moving up or down and off the screen, thereby allowing them to escape, at least briefly—before becoming "dinner."

Micro Jaws will accept as many as nine fish. Five are recommended for the average level of difficulty. To adjust the level of difficulty, set FC (fish count) to any number between 1 and 9 in statement 320. To add more time to the game, just set SEC (time count) in statement 350 to a number higher than 149. You may even want to add some code at line 280 to allow the player to set a difficulty level. You can then use that level to compute values for FC or SEC.

Bon appétit!

Listings on p. 75

RUN the program. The directions for play will appear on the screen. When total frustration finally overwhelms you, type in a 9 and the computer will provide you with some valuable hints and strategy. One of the possible solutions is also available for viewing in this "strategy & hint" mode.

OK, time to put on your armor, mount your trusty steed, and start the tour... Good luck!

EXPLANATION OF THE PROGRAM
Knight's Tour

Line Nos.	
150-260	Program initialization.
270-380	First screen and instructions for play.
470-900	Main game logic.
910-1170	Display subroutines.
1180-1210	Data statements.
1220-1580	Common subroutines.
1720-2010	Display perfect tour.

```
100 REM    *****************
110 REM    * KNIGHT'S TOUR *
120 REM    *****************
130 REM  BY: CURT GARCIA
140 REM      99'er VERSION 2.1.1
150 OPTION BASE 1
160 DIM SQ(8,8)
170 FOR A=110 TO 116
180 READ S$
190 CALL CHAR(A,S$)
200 NEXT A
210 DATA 0,FFFFFFFFFFFFFFFF,0000000
    3070F0F0F,000080C0E0F0F8B8,0703
    03070F0F,98C0C0E0F0F,0000001818
220 CALL CHAR(120,"")
230 CALL COLOR(10,16,11)
240 CALL COLOR(11,2,15)
250 CALL COLOR(12,1,1)
260 GOSUB 1540
270 PRINT "      ** KNIGHT'S TOUR **
    ":::::::::::::
280 CALL SOUND(400,131,3,165,3,330,
    3)
290 CALL SOUND(400,196,3,262,3,330,
    1)
300 CALL SOUND(400,146,3,370,1)
310 CALL SOUND(200,220,3,294,3,370,
    1)
320 CALL SOUND(200,330,1)
330 CALL SOUND(400,196,3,370,1)
340 CALL SOUND(800,250,1,294,1,390,
    1)
350 PRINT "":::::::::
360 FOR Y=4 TO 24
370 GOSUB 1450
380 NEXT Y
390 GOSUB 1220
400 DATA 4,KNIGHT'S TOUR  IS PLAYED
     ON,2,A CHESSBOARD WITH ONE KNI
    GHT.,1,""
410 DATA 4,THE OBJECT OF  THIS GAME
     IS,2,TO LAND ON AS MANY SQUARE
    S AS,2,"POSSIBLE, USING ANY MOV
    ES THE"
420 DATA 2,KNIGHT IS ALLOWED IN CHE
    SS.,1,"",4,"HOWEVER, YOU'RE NOT
     ALLOWED",2,"TO VISIT ANY SQUAR
    E TWICE. TO"
430 DATA 2,"HELP YOU KEEP TRACK, A
    SYMBOL",2,WILL BE PLACED IN THE
     SQUARES,2,YOU'VE VISITED.,1,""
440 DATA 4,IT IS POSSIBLE TO VISIT
    ALL,2,SIXTY-FOUR SQUARES.  WHEN
     YOU,2,"FINISH THE GAME, THE CO
    MPUTER"
450 DATA 2,WILL OFFER TO DISPLAY A
    SOLU-,2,TION.,1,"",6,** TYPE 1
    TO PLAY **
460 DATA 24,3,SELECT NEXT MOVE:,24,
    4,"ILLEGAL MOVE, TRY AGAIN:"
470 GOSUB 1030
480 FOR A=1 TO 8
```

Continued on p. 34

---

the adventuresome submariner. The object of the game is to sink the maximum tonnage of enemy ships with your supply of torpedoes. Quick decisions are required as motion, color and sound are masterfully combined into a new, perilous deep-sea adventure game.

Up Scope! is based on an old BASIC program which has been around for over a decade. The original was exciting in it's day. Our Home Computer version, however, provides substantial improvements such as color graphics, realtime mode of play, sound, and high-score retention.

A high-score file can be maintained on either diskette or tape cassette. When the program is run, a menu screen is displayed which allows you to select the type of high-score file. If no high scoring is desired, answer "N."

If you wish to keep a high-score file, you should answer "I" the *first* time the program is run. This will initialize the 5 highest scores to −1, thus allowing *any* score to be a new high score. Then, for the first 5 games, every game will result in a new high score. Thereafter, either "C" or "D" should be used to respond to the high score query.

During normal play, three commands are available: P for periscope, T for torpedo, and D for dive. The P command will cause a target ship to appear on the periscope. If you are submerged, you will first see the periscope "break water."

Several kinds of ships will appear on the periscope. Some ships, like freighters and tankers, are simply targets. Others are enemy warships that will sink you, if you don't sink them first or dive to safety! Ships may move at two different speeds—the fast ones are harder to sink. When a warship is attacking you, the screen turns red.

The T key fires a torpedo (and is disabled when no ship is in site). Not every torpedo hits (see line 940) and some ships are harder to sink than others (variable Q is the number of hits required to sink).

The D key lets you dive and can be used only when a warship is attacking.

Strategy

Scoring is based upon the amount of enemy tonnage sunk. Therefore, it is best not to waste torpedoes on small ships (except warships, of course). Because large warships (e.g. battleships) are very difficult to sink, it's usually best to dive and "run silent, run deep" when you spot one.

Good hunting, Skipper . . .

Listings on p. 35

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Professor Holl's Pocket Programs . . . and problems in programming

```
100 REM  POCKET BATTLESHIP
110 REM  99'ER VERSION 2.1.1
120 REM  BY S.T. HOLL
130 CALL COLOR(11,16,1)
140 CALL COLOR(12,15,15)
150 CALL CHAR(119,"5A995A3C5A995A99")
160 CALL CLEAR
170 RANDOMIZE
180 NSHOTS=0
190 TRANGE=25000+(RND-.5)*10000
200 GOSUB 410
210 INPUT "INITIAL RANGE?":GRANGE
220 PRINT :::
230 IF ABS(GRANGE-TRANGE)<20 THEN 350
240 GOSUB 410
250 NSHOTS=NSHOTS+1
260 IF GRANGE<TRANGE THEN 290
270 CALL VCHAR(21,22,119,1)
280 GOTO 300
290 CALL VCHAR(21,22,119,2)
300 PRINT "SPOT?"
310 INPUT SPOT
320 GRANGE=GRANGE+SPOT
330 PRINT "GUN RANGE=";GRANGE
340 GOTO 230
350 GOSUB 410
360 PRINT "  SURFACE RAIDER SANK"
370 PRINT "  AFTER ";NSHOTS;" SALVOS."
380 INPUT DUMMY$
390 GOTO 100
400 STOP
410 CALL HCHAR(24,18,123,7)
420 CALL HCHAR(23,20,123,1)
430 PRINT ::
440 RETURN
```

By S.T. Holl

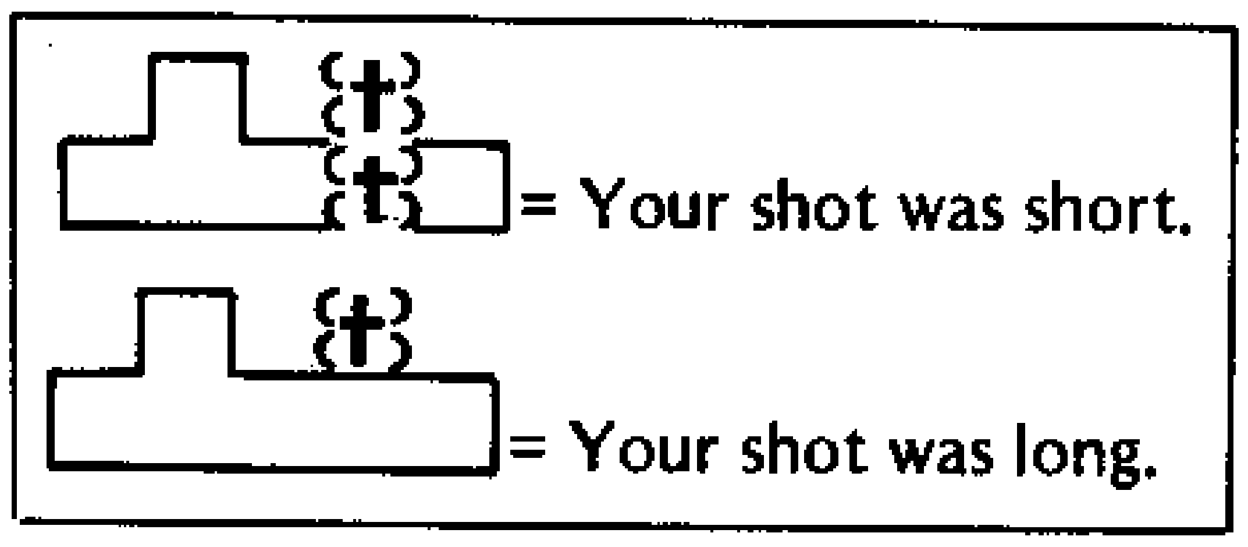
Qtrs 327A, Yerba Buena Island
San Francisco, CA 94130

Today's program:
Pocket Battleship

When I was younger, for a number of years I followed the sea. Those were the days before the invention of RADAR (come now—that's a relatively new invention; most of the battles of World War Two were fought without it). In those days, people in the gunnery business could tell whether their salvos were falling short or long by whether the splashes were in front of or behind the target, but it wasn't possible to tell how *far* short or long the shots were.

There was a considerable amount of trial and error involved; in fact, often there appeared to be more error than anything—what with small variations in the flights of the shells due to heating of the gun barrels and differences in powder weight, as well as the rolling of one's own ship, and the relative motion of the target. The ever-present thought that while I was erring, the other fellow was loading the lucky shot—like the one that took HMS HOOD in the magazine—may have had something to do with my decision to trade the gunner's quadrant in on a (much safer) blackboard compass . . .

Anyhow, with this pocket program you can try your luck at sinking an enemy ship. When you start the program, a ship will appear at some random distance (nominally, with a range of 20,000 to 30,000 yards—as determined by the formula in line 1060). You will be asked for your initial gun range (line 1080); all ranges are in yards. Just type in your first guess and push ENTER. Now watch for the fall of shot, and then give your "spot"—that is, the range correction you want to apply. Use a minus sign before the number of yards if the salvo fell beyond the target; otherwise no sign is required. Again, press ENTER. Repeat until you hit the target; the tolerance is less than 20 yards (line 1090). Once you hit, the number of salvos you fired will be displayed and a new target—at a different range—will appear.



An Analysis of Pocket Features

Pocket sized programs like this one are necesarily simple. However, taking into account the small amount of keying-in required, they can be very entertaining. It is necessary that pocket programs demonstrate at least one powerful language feature or programming technique—or else they wouldn't get the job done in so few lines. This program is condensed slightly by the use of a *subroutine*—in this case, several lines of code (1270-1300) displaying the target ship. These are needed in two places, but they are written only once and invoked twice (lines 1070 and 1100). The program execution returns to the proper place after executing the subroutine because of an inherent characteristic of the BASIC language itself. Beginning TI-99/4 or TI-99/4A users who are unfamiliar with the use of subroutines are encouraged to study the appropriate few pages in the User's Reference Guide. (In the 99/4A version they are pages II-113 to 117).

Homework

The other big plus for pocket-sized programs is that they can be figured out quickly—which means that they are easy to customize. Tailoring programs is good exercise for beginners—the returns come quicker than starting from scratch, and it does force one to start by reading someone else's program.

You'd be amazed how many regular computer users never read other people's programs; from the computer aspect, these people are entirely "self-made men," and the *poorer* for it. Programming languages are, after all, for two type of communication: human-to-computer, AND human-to-human. And for many, it is the latter that is the more important. Enough moralizing (the professor is drifting off target again) . . . There's the bell and here, below, is the homework:

Problem # 1 (Simple): There is no target motion written into the program. Put in some.

Problem # 2 (Simple): Keep track of the *least* number of salvos fired to sink a target each time the program is initiated; also display this number each time a target is sunk.

Problem # 3 (Sound & graphics): Provide a firing noise, and clear the screen (gunflash) each time the gun fires.

Problem # 4 (Graphics & library research): Copy a detailed warship silhouette from *Janes Fighting Ships* at your local library, and code the program to present that as a target.

Problem # 5 (Graphics, and more complicated): Allow the target to fire back, and give it a random chance (or better, an *improving* random chance) of sinking YOU.

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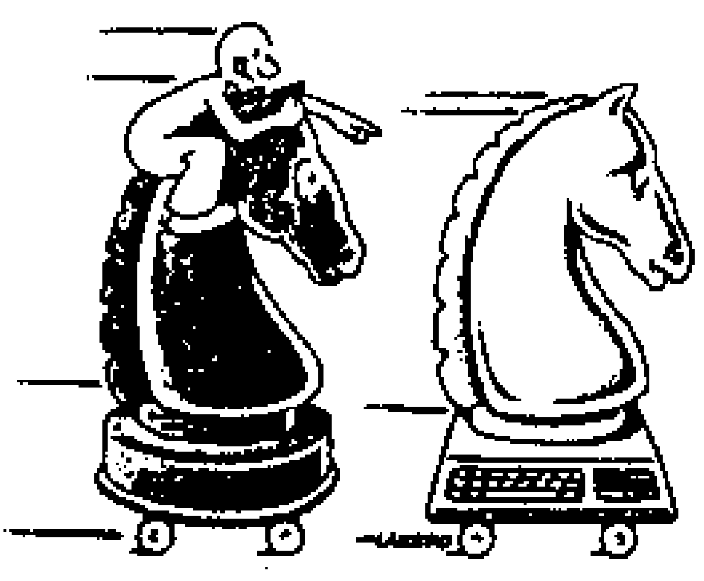
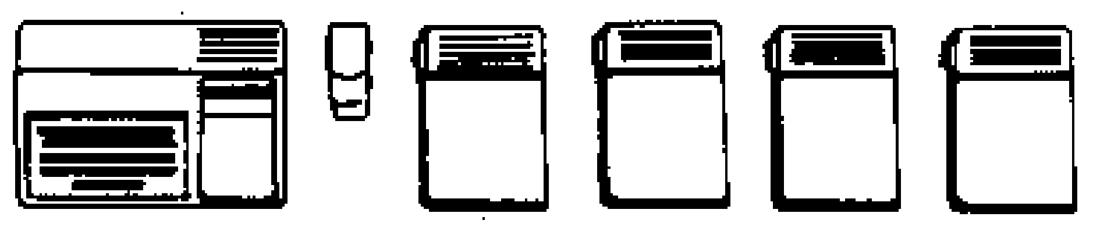
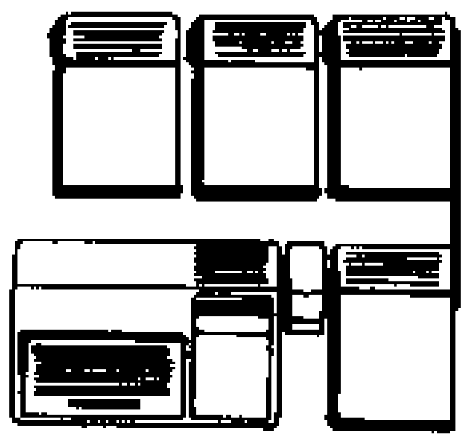
Knights . . . from p. 31



```
490 FOR B=1 TO 8
500 SQ(A,B)=0
510 NEXT B
520 NEXT A
530 M=0
540 M1=3
550 M2=3
560 GOSUB 1440
570 GOSUB 1440
580 GOTO 610
590 RESTORE 460
600 GOSUB 1440
610 GOSUB 1280
620 GOSUB 1360
630 IF M THEN 660
640 GOSUB 980
650 GOTO 780
660 IF SQ(V,H)=0 THEN 730
670 CALL HCHAR(M1,18+M2,120,2)
680 CALL SOUND(150,1400,0)
690 GOSUB 1440
700 GOSUB 1560
710 GOSUB 1420
720 GOTO 590
730 IF ABS(H-H1)<>2 THEN 750
740 IF ABS(V-V1)<>1 THEN 670 ELSE 7
    70
750 IF ABS(V1-V)<>2 THEN 670
760 IF ABS(H1-H)<>1 THEN 670
770 GOSUB 910
780 SQ(V,H)=1
790 V1=V
800 H1=H
810 M=M+1
820 X=28
830 Y=1
840 M$=STR$(M)
850 GOSUB 1460
860 M1=M1+1
870 IF M1<19 THEN 590
880 M1=M1-16
890 M2=M2+3
900 GOTO 590
910 CALL HCHAR(1+(2*V1),2+(2*H1),11
    6)
920 CALL HCHAR(1+(2*V1),3+(2*H1),11
    6)
930 CALL HCHAR(2+(2*V1),2+(2*H1),11
    6)
940 CALL HCHAR(2+(2*V1),3+(2*H1),11
    6)
950 FOR Z=660 TO 720 STEP 15
960 CALL SOUND(-1,Z,3)
970 NEXT Z
980 CALL HCHAR(1+(2*V),2+(2*H),112)
990 CALL HCHAR(1+(2*V),3+(2*H),113)
1000 CALL HCHAR(2+(2*V),2+(2*H),114
     )
1010 CALL HCHAR(2+(2*V),3+(2*H),115
     )
1020 RETURN
1030 GOSUB 1540
1040 RESTORE 1180
1050 FOR Y=3 TO 18
1060 CALL HCHAR(Y,4,110,16)
1070 FOR A=1 TO 4
1080 READ X
1090 CALL HCHAR(Y,X,111,2)
1100 NEXT A
1110 NEXT Y
1120 FOR A=1 TO 3
1130 GOSUB 1440
1140 NEXT A
1150 READ X,Y,M$
1160 GOSUB 1500
1170 RETURN
1180 DATA 6,10,14,18,6,10,14,18,4,8
     ,12,16,4,8,12,16,6,10,14,18,6,
     10,14,18,4,8,12,16,4,8,12,16
1190 DATA 6,10,14,18,6,10,14,18,4,8
     ,12,16,4,8,12,16,6,10,14,18,6,
     10,14,18,4,8,12,16,4,8,12,16
1200 DATA 1,3,* KNIGHT'S TOUR *  MO
     VES:,2,20,***********,19,3,A B
      C D E F G H  ***********
1210 DATA 3,2,1 2 3 4 5 6 7 8,21,4,
     TO QUIT TYPE 9,24,3,STARTING L
     OCATION?
1220 CALL SOUND(100,1600,2)
1230 CALL KEY(0,KEY,ST)
1240 IF ST=0 THEN 1230
1250 IF (KEY<49)+(KEY>51)THEN 1220
1260 KEY=KEY-48
1270 RETURN
1280 CALL SOUND(50,1400,2)
1290 CALL KEY(0,KEY,ST)
1300 IF ST=0 THEN 1290
1310 IF (KEY<49)+(KEY>57)THEN 1280
1320 IF KEY=57 THEN 1590
1330 CALL HCHAR(M1,18+M2,KEY)
1340 V=KEY-48
1350 RETURN
1360 CALL SOUND(50,1400,2)
1370 CALL KEY(0,KEY,ST)
1380 IF ST=0 THEN 1370
1390 IF (KEY<65)+(KEY>72)THEN 1360
1400 CALL HCHAR(M1,19+M2,KEY)
1410 H=KEY-64
1420 CALL HCHAR(24,2,120,28)
1430 RETURN
1440 READ Y
1450 READ X,M$
1460 FOR I=1 TO LEN(M$)
1470 CALL HCHAR(Y,X+I,ASC(SEG$(M$,I
     ,1)))
1480 NEXT I
1490 RETURN
1500 FOR I=1 TO LEN(M$)
1510 CALL HCHAR(Y+I,X,ASC(SEG$(M$,I
     ,1)))
1520 NEXT I
```

Continued on p. 78

THIS  **BECOMES** 

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Up Scope . . . from p. 31

EXPLANATION OF THE PROGRAM

Up Scope

Line Nos.	
170-230	High score file handling. This either retrieves the file, initializes the B array for future file creation, or ignores high scores altogether.
240-260	Initialize and query for instructions.
270	Set mask string. Could be MASK$ = "TDP" but this form is for easier understanding—a matter of taste.
280-450	Instructions.
460-470	Define and create diving submarine.
480	If we're keeping track, display all-time best games.
490-500	Kill some time making sonar noise while player reads high score.
510-560	Initialize some more. Not CALL SUBMERGE sets periscope to initial "undersea" view.
570-660	Routine to give high probability of encountering an attacking warship.
670-690	Main loop for checking keyboard input and sprites on screen.
700-710	Handle failure to sink civilian target.
720-890	Periscope routine.
900-1010	Torpedo firing routine. Lines 970-980 make ship explode.
1020-1060	Start dive.
1070	Generate depth charges.
1080-1110	Check ending condition.
1120	Dive successful!
1130-1140	Dive not so successful!
1150	Failed to sink enemy warship.
1170-1320	Clean up at end, record best scores (if needed), and play some stirring music.
1410-1430	Subroutine for displaying data about ship sited.
1440	Subroutine to display command menu.
1450-1510	Subroutine to define sprite patterns for ships.
1520	Sound delay subroutine to slow down sonar loop in line 500.
1530-1550	Attack ship set-up subroutines.
1570	Screen header subroutine.
1580-1600	Subroutine to display best game scores.
1610-1700	Subprograms.

```
100 REM ******************
110 REM *    UP SCOPE!    *
120 REM ******************
130 REM
140 REM BY J.R.DEW
150 REM 99'er VERSION 2.1.1XB
160 REM
170 DEF WT(X)=X*100+100*INT(RND*6)
180 GOSUB 1570 :: DISPLAY AT(8,1):"
    BEST SCORE FILE:":" C-CASSETTE"
    :" D-DISKETTE":" N-NONE":" I-IN
    ITIALIZE" :: MASK$="CDNI" :: GO
    SUB 1560
190 SFTYPE=K2 :: ON K2 GOTO 200,210
    ,240,230
200 OPEN #1:"CS1",FIXED,INPUT ,SEQU
    ENTIAL,INTERNAL :: GOTO 220
210 OPEN #1:"DSK1.FISHFILE",INPUT ,
    SEQUENTIAL,INTERNAL
220 FOR X=1 TO 5 :: INPUT #1:B(X),B
    EST$(X):: NEXT X :: CLOSE #1 ::
     GOTO 240
230 FOR X=1 TO 5 :: B(X)=-1 :: NEXT
     X :: DISPLAY AT(11,2):"":"":"C
    HOOSE C OR D" :: MASK$="CD" ::
    GOSUB 1560 :: SFTYPE=K2
240 TURN=0
250 RANDOMIZE :: GOSUB 1570 :: X$=R
    PT$("0",16)
260 DISPLAY AT(22,1):"INSTRUCTIONS
    (Y/N)" :: MASK$="YN" :: GOSUB 1
    560
270 MASK$=CHR$(84)&CHR$(68)&CHR$(80
    ):: IF K2=2 THEN 460
280 DISPLAY AT(1,1)ERASE ALL:" YOU
    HAVE 3 COMMANDS:"
```

Continued on p. 36

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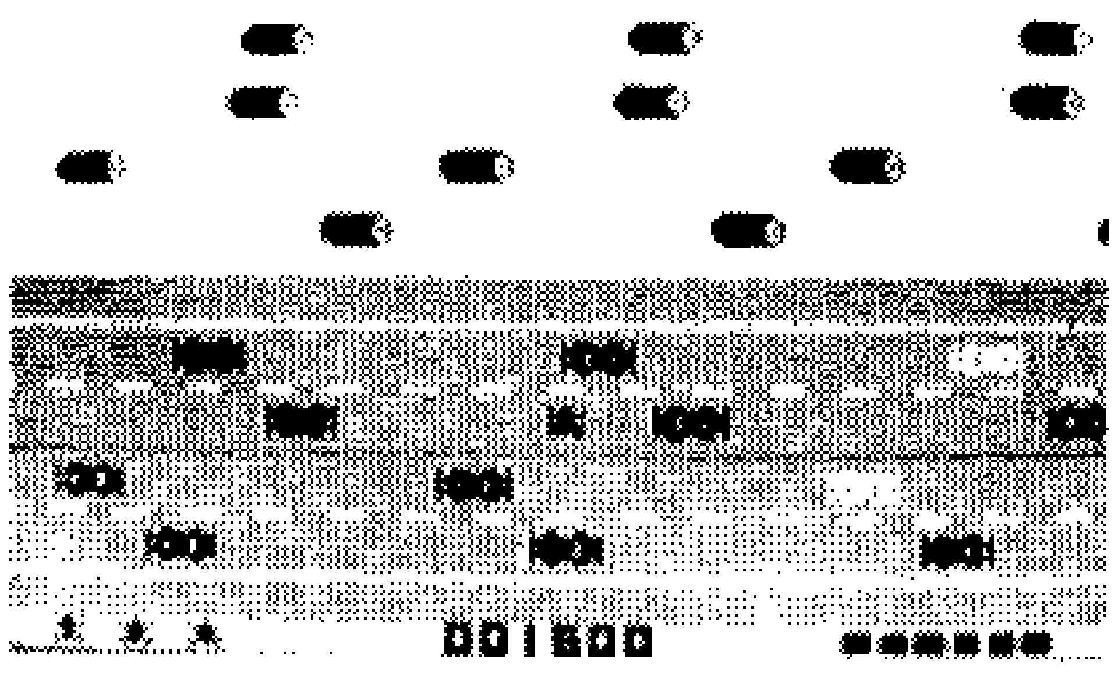

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Up Scope . . . from p. 35

```
290 DISPLAY AT(2,1):" P-PERISCOPE:B
    RINGS A SHIP"
300 DISPLAY AT(3,1):"   INTO VIEW O
    N YOUR"
310 DISPLAY AT(4,1):"   PERISCOPE"
320 DISPLAY AT(5,1):" T-FIRES TORPE
    DO"
330 DISPLAY AT(6,1):" D-DIVE. THIS
    SHOULD BE USED"
340 DISPLAY AT(7,1):"   ONLY WHEN U
    NDER ATTACK."
350 DISPLAY AT(9,1):" WHEN THE SCRE
    EN TURNS RED"
360 DISPLAY AT(10,1):" YOU ARE UNDE
    R ATTACK. YOU"
370 DISPLAY AT(11,1):" MUST EITHER
    SINK YOUR"
380 DISPLAY AT(12,1):" ATTACKER WIT
    H TORPEDO FIRE"
390 DISPLAY AT(13,1):" OR DIVE FOR
    SAFETY-BUT"
400 DISPLAY AT(14,1):" WATCH OUT FO
    R DEPTH CHARGES"
410 DISPLAY AT(16,1):" THE OBJECT O
    F THE GAME IS"
420 DISPLAY AT(17,1):" TO SINK THE
    MAXIMUM TONNAGE"
430 DISPLAY AT(18,1):" OF ENEMY SHI
    PS WITH YOUR"
440 DISPLAY AT(19,1):" SUPPLY OF TO
    RPEDOES."
450 DISPLAY AT(24,2):"PRESS ENTER T
    O PLAY" :: ACCEPT AT(24,26):E$
    :: CALL CLEAR
460 CALL CHAR(136,X$&"3F7F3F0000000
    000000000000000040E0FCFEFC000000
    0000")
470 CALL SPRITE(#6,136,3,1,100,2,0)
    :: CALL MAGNIFY(4)
480 IF B(1)<>0 THEN GOSUB 1580
490 DISPLAY AT(24,2):"PRESS ENTER T
    O PLAY"
500 CALL SONAR :: GOSUB 1520 :: CAL
    L KEY(0,K,S):: IF K<>13 THEN 50
    0
510 CALL CLEAR :: CALL DELSPRITE(#6
    ):: Y$="FFFFFFFFFFFFFFFF" :: CA
    LL COLOR(13,9,1):: CALL COLOR(1
    2,4,1):: CALL COLOR(9,6,4)
520 CALL CHAR(128,Y$):: CALL CHAR(1
    20,Y$):: CALL SUBMERGE
530 CALL CLEAR :: DISPLAY AT(2,7):"
    SUBMARINE NAME" :: ACCEPT AT(3,
    12)SIZE(12)BEEP:A$
540 CALL CHAR(116,X$&"0041001108050
    215"&X$&"0004001020408050")
550 CALL CLEAR
560 SITED,PSTAT=0 :: T=16 :: A=INT(
    RND*10):: GOTO 640
570 D=INT(RND*10)
580 IF D<6 THEN 640
590 IF D<8 THEN Q=2 :: GOSUB 1530 :
    : GOTO 610
600 Q=1 :: IF D=8 THEN GOSUB 1540 E
    LSE GOSUB 1550
610 GOSUB 1330 :: GOSUB 1410
620 DISPLAY AT(14,13):"ATTACKING"
630 CALL SCREEN(10):: CALL SONAR ::
     CALL SHIP :: GOTO 650
640 CALL SCREEN(15)
650 GOSUB 1330 :: CALL SONAR :: GOS
    UB 1440
660 DISPLAY AT(14,1):" "
670 IF T=0 THEN 1160 ELSE CALL KEY(
    0,K,S):: IF S<>0 THEN K2=POS(MA
    SK$,CHR$(K),1):: IF K2=0 THEN 6
    80 ELSE ON K2 GOTO 900,1020,720
680 IF SITED=0 THEN 670 ELSE CALL P
    OSITION(#9,Y,X):: IF X>96 THEN
    670 ELSE CALL DELSPRITE(#9)
690 IF D>5 AND Q>0 THEN 1150
700 DISPLAY AT(13,1):" " :: DISPLAY
     AT(14,1):" " :: DISPLAY AT(5,2
    2):" " :: DISPLAY AT(6,22):" "
710 CALL FIREDISP(0):: SITED,F,D,Q=
    0 :: A=INT(RND*(TURN+10)):: GOT
    O 570
720 REM ***PERISCOPE***
730 IF SITED<>0 THEN 670 ELSE D,SIT
    ED=1
740 IF PSTAT=1 THEN PSTAT=2 :: CALL
     SURFACE
750 IF A>8 THEN 820
760 IF A>3 THEN 770 ELSE R$="FREIGH
    TER" :: GOSUB 1480 :: W=WT(65)
770 IF A<7 THEN 780 ELSE R$="TANKER
    " :: GOSUB 1490 :: W=WT(92)
780 IF A<4 OR A>5 THEN 790 ELSE R$=
    "TRANSPORT" :: GOSUB 1480 :: W=
    WT(100)
790 IF A<>6 THEN 800 ELSE R$="AMMUN
    ITION SHIP" :: GOSUB 1480 :: W=
    WT(90)
800 IF A=6 THEN Q=1 ELSE Q=2
810 GOTO 890
820 E=INT(RND*10):: D=9
830 IF E<>0 THEN 840 ELSE R$="BATTL
    ESHIP" :: GOSUB 1500 :: W=WT(33
    0):: Q=6 :: GOTO 890
840 IF E<>1 THEN 850 ELSE R$="AIRCR
    AFT CARRIER" :: GOSUB 1510 :: W
    =WT(250):: Q=4 :: GOTO 890
850 IF E<>2 THEN 860 ELSE R$="HEAVY
     CRUISER" :: GOSUB 1450 :: W=WT
    (99):: Q=3 :: GOTO 890
860 IF E<>3 THEN 870 ELSE R$="LIGHT
     CRUISER" :: GOSUB 1450 :: W=WT
    (9):: Q=3 :: GOTO 890
870 IF E<4 OR E>5 THEN 880 ELSE R$=
    "DESTROYER" :: GOSUB 1450 :: W=
    WT(21):: Q=2 :: GOTO 890
880 R$="DESTROYER ESCORT" :: GOSUB
```

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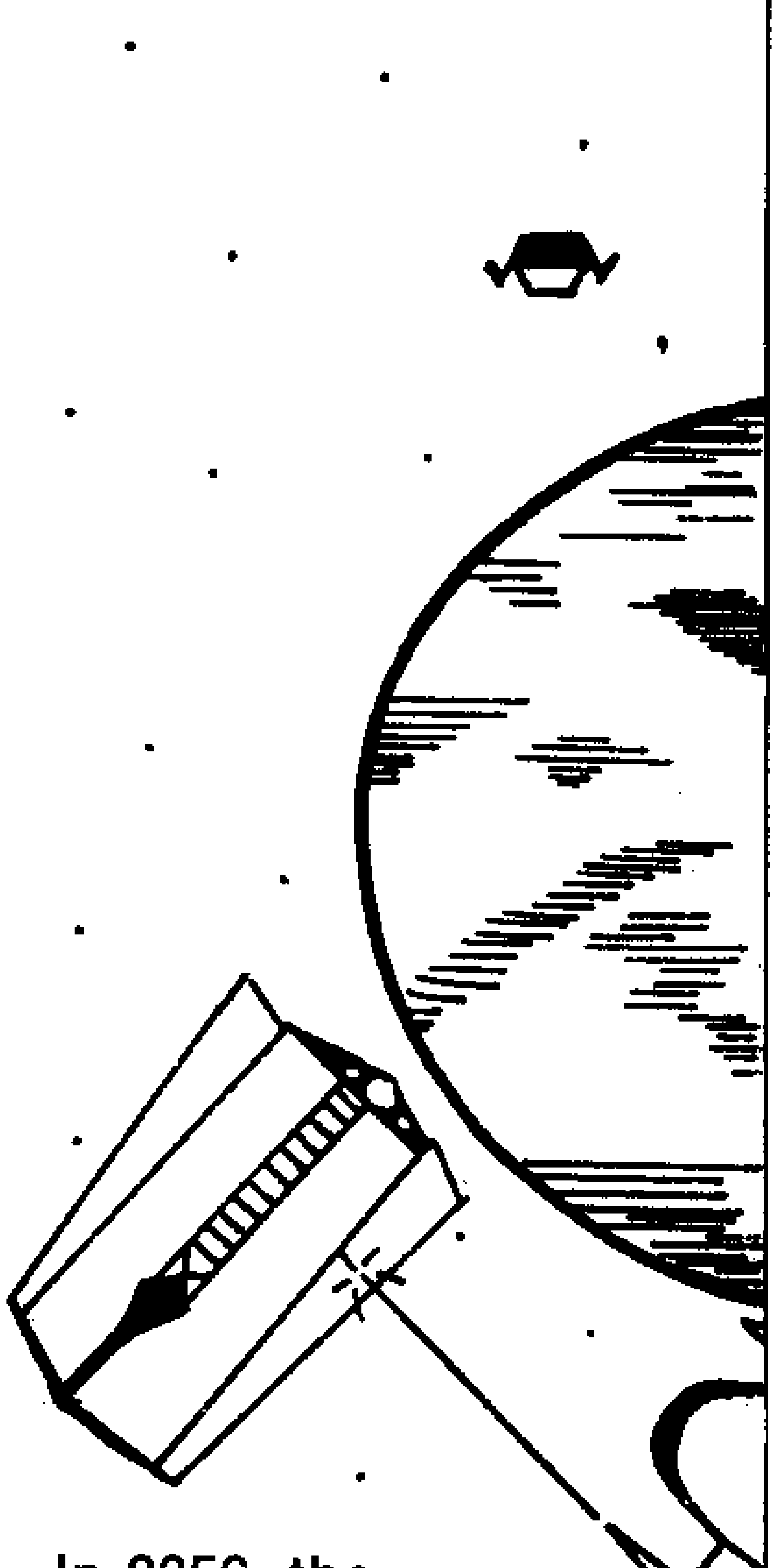

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```
     1460 :: W=1350 :: Q=1 :: GOTO 8
     90
890 CALL SHIP :: GOSUB 1410 :: GOTO
      670 !DRAW SHIP & DESCRIBE
900 REM ***TORPEDO***
910 IF Q<1 THEN CALL SONAR :: GOTO
    670
920 CALL FIREDISP(F+1):: F=F+1 :: C
    ALL SOUND(600,110,5,-7,0)
930 T=T-1 :: DISPLAY AT(4,5)SIZE(3)
    :T
940 IF RND>.275 THEN Q=Q-1
950 IF Q>0 AND A>8 THEN CALL SCREEN
    (10)
960 TURN=TURN+.2 :: IF Q>0 THEN 670
970 D=D+W :: L=L+1 :: CALL POSITION
    (#9,Y,X)
980 CALL SPRITE(#9,116,7,Y,X,0,0)
990 DISPLAY AT(14,13):"  SUNK" :: D
    ISPLAY AT(24,14):D
1000 TURN=TURN+.8 :: CALL SCREEN(12
     )
1010 F,D,Q=0 :: CALL SONAR :: CALL
     FIREDISP(0):: CALL DELSPRITE(#
     9):: A=INT(RND*10):: GOTO 640
1020 REM ***DIVE***
1030 PSTAT,F=0 :: CALL DELSPRITE(#9
     ):: CALL SCREEN(4):: CALL CLEA
     R
1040 CALL SPRITE(#1,136,13,1,128,2,
     0):: CALL SONAR
1050 IF Q=0 THEN 1080
1060 CALL CHAR(104,RPT$("0",15)&"3C
     "&RPT$("0",30)&"C3")
1070 FOR X=1 TO INT(RND*1900):: NEX
     T X :: CALL SPRITE(#2,104,2,1,
     128,1+INT(RND*7),0)
1080 CALL POSITION(#1,Y,X):: IF Y>1
     92 THEN 1120
1090 CALL POSITION(#2,Y,X):: IF Y>1
     92 THEN 1120
1100 CALL DISTANCE(#1,#2,X)
1110 IF X<25 THEN 1130 ELSE CALL SO
     NAR :: GOTO 1080
1120 CALL SCREEN(12):: CALL DELSPRI
     TE(#1,#2):: PSTAT,SITED,D,Q=0
     :: CALL SUBMERGE :: A=INT(RND*
     (TURN+10)):: GOTO 640
1130 CALL DELSPRITE(ALL):: CALL SOU
     ND(2500,-7,0)
1140 DISPLAY ERASE ALL:"THE USS ";A
     $:"HAS BEEN SUNK BY":"DEPTH CH
     ARGES" :: GOTO 1180
1150 DISPLAY ERASE ALL:"THE USS ";A
     $:"HAS BEEN SUNK BY GUNFIRE" :
     : GOTO 1180
1160 IF D>5 AND Q>0 THEN 1150
1170 DISPLAY ERASE ALL:"OUT OF TORP
     EDOES":"END OF MISSION"
1180 PRINT "YOU SUNK";L;" SHIPS":"
            ";D;" TONS" :: CALL DEL
     SPRITE(ALL)
1190 IF SFTYPE=3 THEN 1250
1200 FOR X=1 TO 5 :: IF D<=B(X)THEN
      1240
1210 FOR Y=5 TO X STEP -1 :: B(Y)=B
     (Y-1):: BEST$(Y)=BEST$(Y-1)::
     NEXT Y :: B(X)=D :: BEST$(X)=A
     $ :: GOSUB 1580
1220 IF SFTYPE=2 THEN OPEN #1:"DSK1
     .FISHFILE",SEQUENTIAL,OUTPUT,I
     NTERNAL ELSE OPEN #1:"CS1",FIX
     ED,SEQUENTIAL,OUTPUT,INTERNAL
1230 FOR X=1 TO 5 :: PRINT #1:B(X),
     BEST$(X):: NEXT X :: CLOSE #1
     :: GOTO 1250
1240 NEXT X
1250 L,F,D=0 :: Q=300
1260 CALL SOUND(Q*2,131,0)
1270 CALL SOUND(Q,165,0)
1280 CALL SOUND(Q,196,0)
1290 CALL SOUND(Q*1.5,220,0)
1300 CALL SOUND(.5*Q,165,0)
1310 CALL SOUND(2*Q,220,0)
1320 CALL SOUND(4000,3000,30):: GOT
     O 240
1330 REM DRAW PERISCOPE ETC
1340 IF PSTAT<>0 THEN 1400 ELSE PST
     AT=1
1350 DISPLAY AT(1,14-LEN(A$)/2-2):"
     USS ";A$
1360 CALL HCHAR(2,12,128,10):: CALL
      HCHAR(11,12,128,10)
1370 CALL VCHAR(3,12,128,8):: CALL
     VCHAR(3,21,128,8)
1380 DISPLAY AT(3,3)SIZE(5):"TORPS"
      :: DISPLAY AT(4,5)SIZE(3):T
1390 FOR X=3 TO 6 :: CALL HCHAR(X,1
     3,93+X,8):: CALL HCHAR(X+4,13,
     120,8):: NEXT X
1400 DISPLAY AT(24,1):D :: RETURN
1410 SITED=1 :: DISPLAY AT(13,4):"E
     NEMY"
1420 DISPLAY AT(13,13):R$ :: DISPLA
     Y AT(5,23):W
1430 DISPLAY AT(6,24):"TONS" :: RET
     URN
1440 DISPLAY AT(20,2):"P=PERISCOPE"
     :" T=TORPEDO":" D=DIVE" :: DIS
     PLAY AT(16,2):"ORDERS COMMANDE
     R?" :: RETURN
1450 CALL CHAR(132,X$&"00000000014
     7F3F"&X$&"0000000060F4FEFC")::
      RETURN ! CRUISER & DESTROYER
1460 CALL CHAR(132,X$&"0000000000A
     3F1F"&X$&"00000000060FCF8")::
      RETURN ! ESCORT
1470 CALL CHAR(132,X$&"000000000000
     000F"&X$&"00000000000060F0")::
      RETURN ! TORPEDO BOAT
1480 CALL CHAR(132,X$&"00000000007F
     3F1F"&X$&"00000050F8FEFCF8")::
      RETURN ! FREIGHTER ETC.
```

Continued on p. 78

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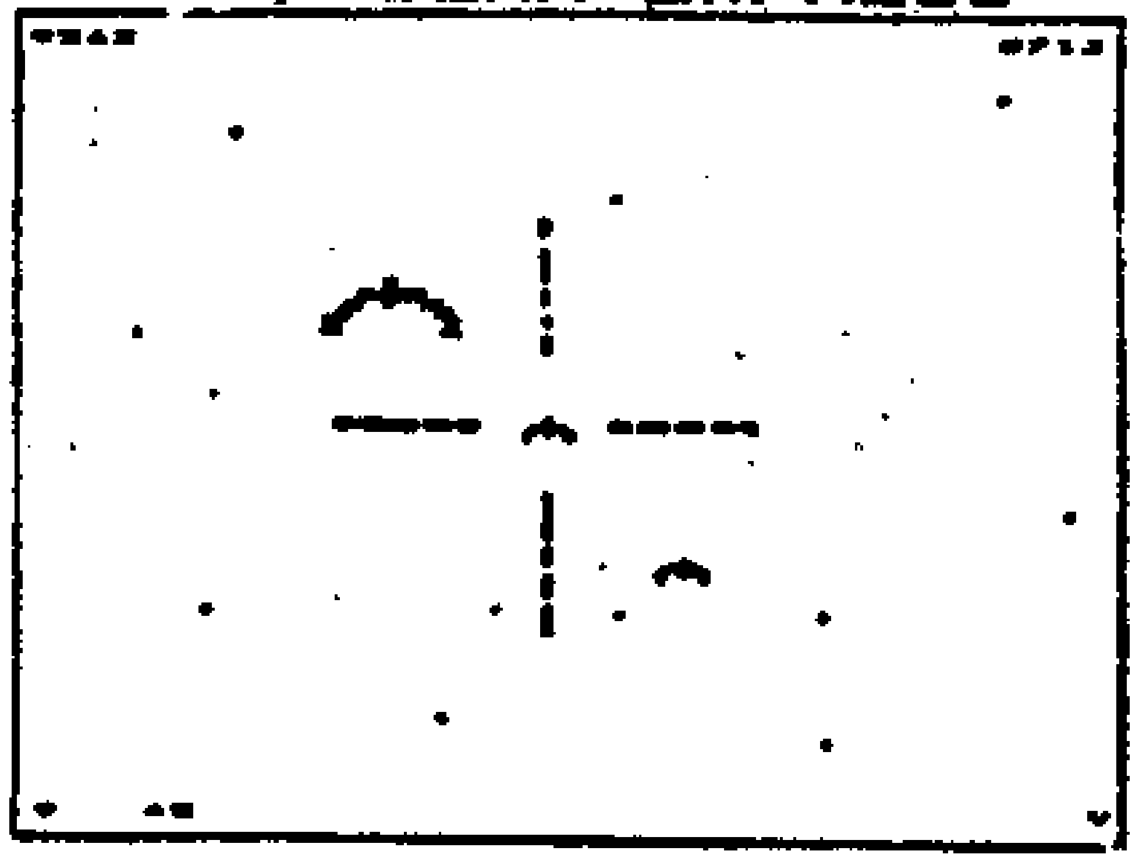

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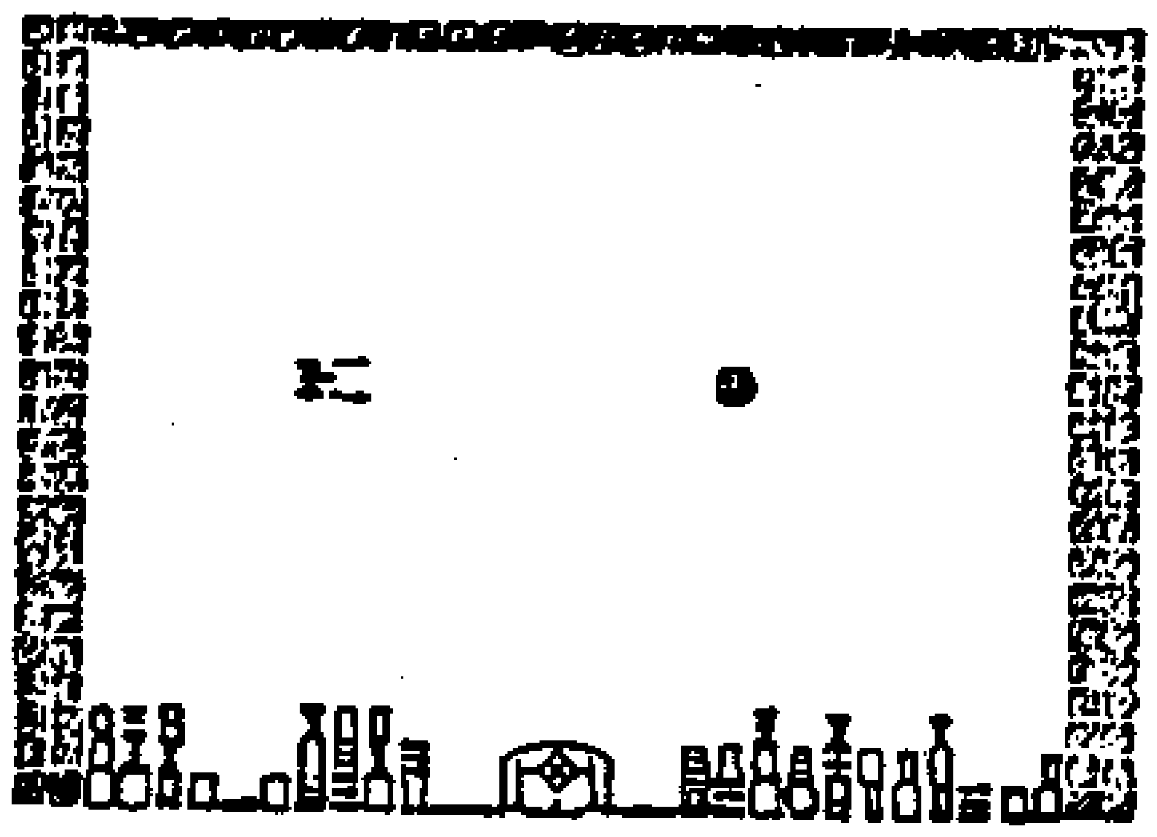

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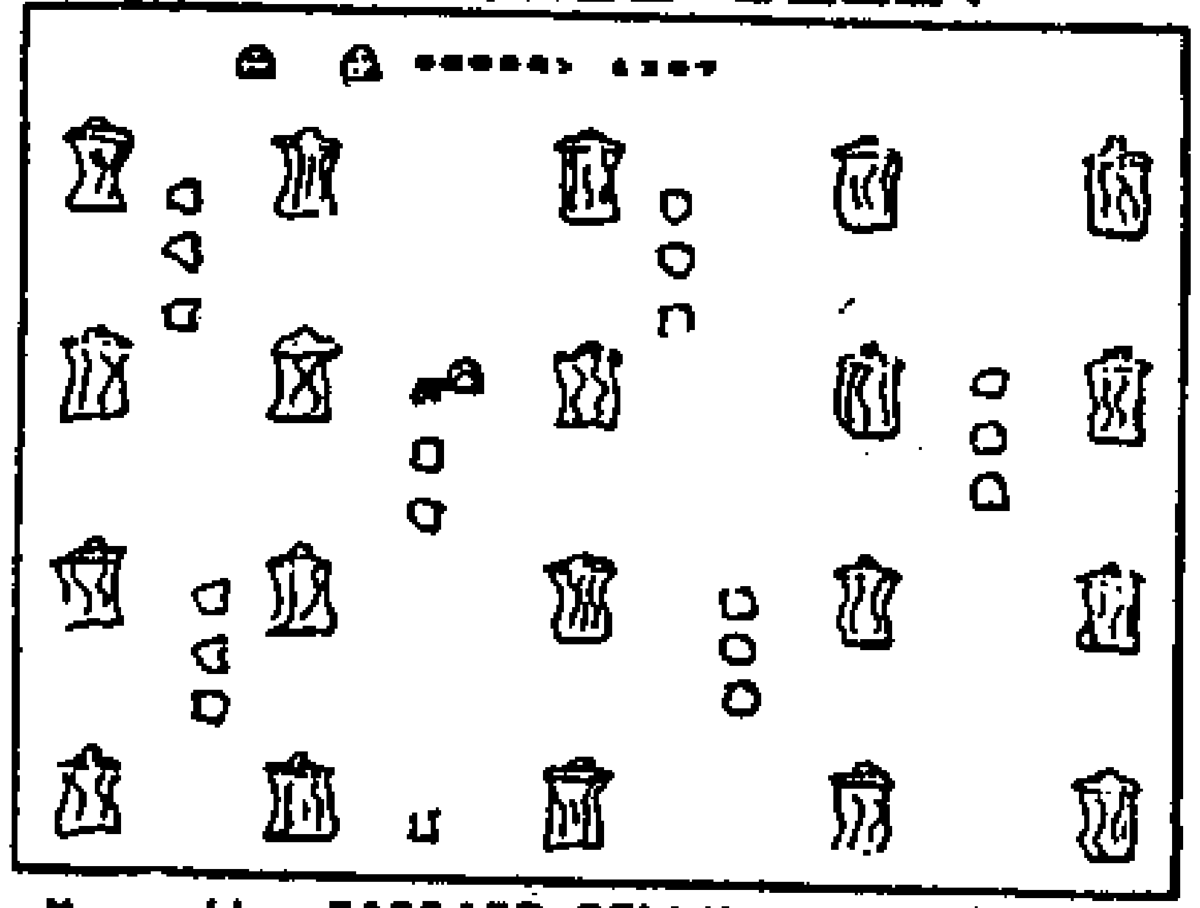

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OK, head out cross-country now. Try to work the thermals over rocky fields, but avoid lakes and forests — they usually have heavy downdrafts over them. Look at that eagle circling; he sure knows where the thermals are.

Its getting late, time to be heading back. The thermals are gone and there is no more ridge lift, so you had better pick your spot to land. Push the bar forward slowly and stall it on. Slow down or you'll break your neck! That's it.

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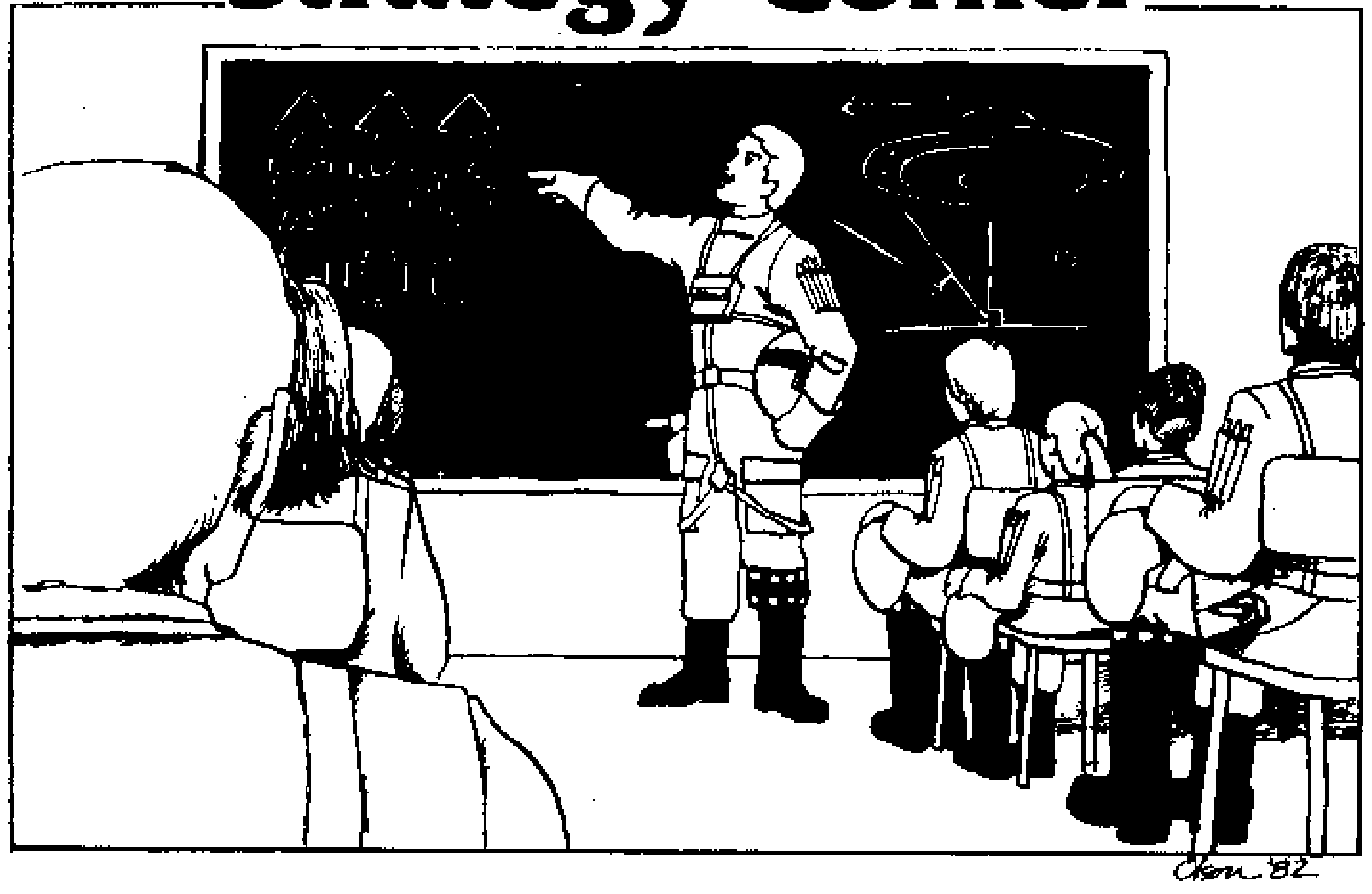
Strategy Corner



MUNCH MAN

Strategy By Carol Bujak
Roselle, IL
As Reported by Steve Schwartz
99'er Game Reviewer

DESCRIPTION: Four cunning "Hoonos" are in pursuit of your Munch Man. Can he make it to an "energy pellet" in time to change the attack or will the Hoonos devour him? You must out-maneuver the Hoonos as you try to place "chain links" throughout the maze, without being eaten by the Hoonos. A one-player game, designed to give hours of family entertainment.

STRATEGY: Because almost everyone is familiar with Munchman—TI's best game cartridge so far—I won't waste any more time describing the action of the game. Although I'm far from a master, I recently met someone who *is*—a 14-year-old girl who spends much of her time "laying down the chain."

She almost always scores the maximum 8,700 points on the first screen. Since the Hoonos are relatively slow, she is sure to gobble them all up each time she eats an energy pellet. Of course, she is careful that she doesn't complete the chain too early.

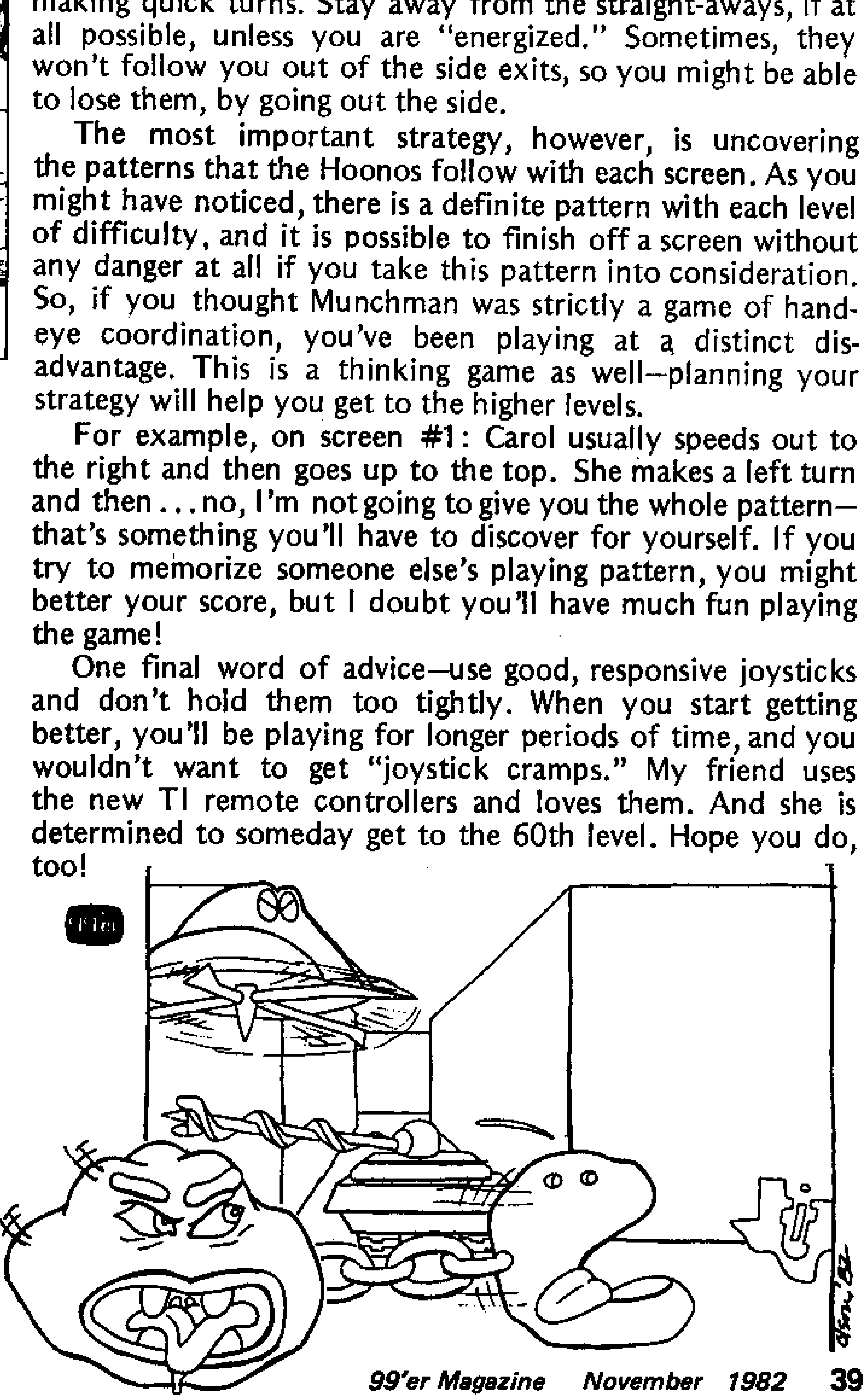
As the Hoonos speed up with each succeeding level, you'll want to concentrate more on laying the chain rather than eating the Hoonos. (Of course, if they happen to get in your way, don't hesitate to gobble them up!) Here's an important suggestion from my young friend. Ask yourself at which screen you usually lose your first Munchman. Then *that's* the screen where you should start leaving the Hoonos alone. Keep in mind, however, that it's *always* permissible to eat them when they are in your immediate vicinity.

At the 12th screen, the Hoonos become faster than you. When this happens, it's often possible to lose them by making quick turns. Stay away from the straight-aways, if at all possible, unless you are "energized." Sometimes, they won't follow you out of the side exits, so you might be able to lose them, by going out the side.

The most important strategy, however, is uncovering the patterns that the Hoonos follow with each screen. As you might have noticed, there is a definite pattern with each level of difficulty, and it is possible to finish off a screen without any danger at all if you take this pattern into consideration. So, if you thought Munchman was strictly a game of hand-eye coordination, you've been playing at a distinct disadvantage. This is a thinking game as well—planning your strategy will help you get to the higher levels.

For example, on screen #1: Carol usually speeds out to the right and then goes up to the top. She makes a left turn and then . . . no, I'm not going to give you the whole pattern—that's something you'll have to discover for yourself. If you try to memorize someone else's playing pattern, you might better your score, but I doubt you'll have much fun playing the game!

One final word of advice—use good, responsive joysticks and don't hold them too tightly. When you start getting better, you'll be playing for longer periods of time, and you wouldn't want to get "joystick cramps." My friend uses the new TI remote controllers and loves them. And she is determined to someday get to the 60th level. Hope you do, too!



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DEBUGS ON DISPLAY

99'er Program Bug

County Fair Derby Finishes

If you have been frustrated in your attempts to get the County Fair Derby program to run in Vol. 1, No. 6, we must apologize. There are hundreds of thousands of places to make errors in the production of a magazine and while we scrutinized spelling, color usage, etc. The last few lines of County Fair Derby fluttered unnoticed to the floor. So here, continued from 99'er Vol. 1, No. 6 page 51, is the rest of the program:

```
4090 TOT(X)=TOT(X)+BET(X)
4100 PRINT "GREAT*";NAME$(
     X);" YOU WIN $";BET(X
     )::
4110 PRINT "YOU NOW HAVE
     $";TOT(X)::
4120 RETURN
4130 PRINT "PRESS ANY KEY"
4140 CALL KEY(O,KEY,STATUS
     )
4150 IF STATUS=0 THEN 4140
4160 IF NAME$(X)<>"LAST" T
     HEN 3930
4170 CALL CLEAR
4180 L(K)=L(K)+1
4190 U(D)=U(D)+1
4200 W(S)=W(S)+1
4210 PRINT TAB(8);"PAST RE
     CORDS":::
4220 PRINT "NO:1 ";W(1);"W
     IN";L(1);"PLACE";U(1)
     ;"SHOW"
4230 PRINT :"NO:2 ";W(2);"
     WIN";L(2);"PLACE";U(2
     );"SHOW"
4240 PRINT :"NO:3 ";W(3);"
     WIN";L(3);"PLACE";U(3
     );"SHOW"
4250 PRINT :"NO:4 ";W(4);"
     WIN";L(4);"PLACE";U(4
     );"SHOW"
4260 PRINT :"NO:5 ";W(5);"
     WIN";L(5);"PLACE";U(5
     );"SHOW"
4270 PRINT ::"PRESS ENTE
4280 CALL KEY(0,KEY,STAT
     )
4290 IF STATUS=0 THEN 42
4300 CALL CLEAR
4310 X=1
4320 IF NAME$(X)="LAST"
     EN 1570
4330 GOSUB 1230
4340 GOTO 4320
4350 DATA 1,523,1,523,1,
     3,1,440,1,440,1,440
     ,349,1,440,1,349,2,
     6
4360 DATA 1,349,1,440,1,
     3,1,523,1,523,1,440
     ,440,1,440,1,256,1,
     6,1,330,2,349,0,0
4370 DATA 1,392,1,392,1,
     2,1,330,1,392,1,440
     ,392,2,330,2,294,1,
     0,2,294
4380 DATA 1,392,1,392,1,
     2,1,330,1,392,1,440
     ,392,2,330,2,294,1,
     0,1,294,2,256,0,0
```

Spriter Revisited (and redone...)

After many attempts at getting the original Spriter program to work on all versions of TI Extended BASIC, the 99'er technical staff came up with a fully reworked listing. Please note that the original Spriter works fine with the older Extended BASIC (version 100) and is a fine example of programming with subroutines. If you could not get the original version to work, try this version, it has been tested on both old and new Extended BASIC modules:

[See Vol. 1, No. 5 for documentation.]

```
100 REM ********************
    .***
110 REM *         SPRITER
       *
120 REM ********************
    ***
130 REM
140 REM BY FERNANDO
145 REM     CARACENA
150 REM 99'ER VERSION
155 REM     1.5.2XB
160 CALL CHARSET :: FOR I=
    96 TO 143 :: CALL CHAR
    (I,""):: NEXT I
170 INPUT " DO YOU HAVE A
    THERMAL PRINTER(Y/N)?"
    :TP$
180 DIM CHA$(50),ID$(50)
190 INPUT "DO YOU WANT TO
    INPUT A FILE OF CHARAC
    TERS FROM TAPE OR  DIS
    K (Y/N)?":AN$ :: IF AN
    $<>"Y" THEN 240
200 DISPLAY AT(24,1):"FILE
     NAME" :: ACCEPT AT(24
    ,11)SIZE(10)VALIDATE(U
    ALPHA,DIGIT):NAM$ :: I
    F POS(NAM$," ",1)<>0 T
    HEN 200
210 PRINT "ENTER '1' FOR T
    APE                '2'
     FOR DISK" :: INPUT "(
    1/2)?":AN$
220 IF AN$="1" THEN @FILE$
    ="CS1" ELSE IF AN$="2"
     THEN @FILE$="DSK1."&N
    AM$ ELSE GOTO 210
230 GOSUB 1280 :: GOTO 250
240 IF AN$<>"N" THEN 190
    LSE NS=0 :: GOTO 290
250 IF TP$="N" THEN 280
260 OPEN #1:"TP.U.E.S",OU
    PUT :: FOR J=0 TO NS
270 PRINT #1:J,ID$(J):: N
    XT J :: CLOSE #1
280 NS=NS+1 :: C$=CHA$(0)
290 FOR I=NS TO 1000
300 GOSUB 520
310 DISPLAY AT(2,1):ID$(N
    ):: DISPLAY AT(22,1):
    $
320 DISPLAY AT(3,1):"PRES
     ANY KEY TO CONTINUE.
330 CALL KEY(0,K,S):: IF
    =0 THEN 330
340 CALL CLEAR :: INPUT "
    NTER COLOR CODE FOR S
    RITE. ":COL
350 CALL CHAR(96,C$):: CA
    L SPRITE(#1,96,COL,30
    30,0,-30):: CALL MAGN
    FY(4)
360 DISPLAY AT(10,3):"PRE
    S ANY KEY TO CONTINUE
    "
370 CALL KEY(0,K,S):: IF
```

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```
      =0 THEN 370 ELSE CALL
      DELSPRITE(ALL)
  380 INPUT "DO YOU WANT TO
      SAVE THE CHARACTER COD
      E OF THIS SPRITE(Y/N)?
      ":AN$
  390 IF AN$="Y" THEN CHA$(N
      S)=C$
  400 INPUT "DO YOU WANT TO
      CONTINUE(Y/N)?":AN$ ::
       IF AN$="N" THEN 430 E
      LSE IF AN$<>"Y" THEN 4
      00
  410 NS=NS+1
  420 NEXT I :: END
  430 INPUT "DO YOU WISH TO
      SAVE RESULTS ON TAPE O
      R DISK(Y/N)?":AN$
  440 IF AN$="N" THEN 510 EL
      SE IF AN$<>"Y" THEN 43
      0
  450 DISPLAY AT(24,1):"ENTE
      R FILE NAME" :: ACCEPT
       AT(24,11)SIZE(10)VALI
      DATE(UALPHA,DIGIT):NAM
      $ :: IF POS(NAM$," ",1
      )<>0 THEN 450
  460 PRINT "ENTER '1' FOR T
      APE                 '2'
       FOR DISK" :: INPUT "(
      1/2)?":AN$
  470 IF AN$="1" THEN @FILE$
      ="CS1" ELSE IF AN$="2"
       THEN @FILE$="DSK1."&N
      AM$ ELSE GOTO 460
  480 OPEN #1:@FILE$,INTERNA
      L,OUTPUT,FIXED 128
  490 PRINT #1:NAM$,NS
  500 FOR K=0 TO NS :: PRINT
       #1:ID$(K),CHA$(K):: N
      EXT K :: CLOSE #1
  510 END
  520 REM SUB DRAWER(TP$,C$,
      NS,AN$,CHA$(),ID$())
  525 CALL CHAR(33,RPT$("F",
      16))
  530 IF C$="" THEN 580
  540 INPUT "DO YOU WANT TO
      INITIALIZE WITH A PREV
      IOUSLY DEFINED CHARACT
      ER(Y/N)?":AN$
  550 IF AN$="N" THEN C$=""
      :: GOTO 580 ELSE IF AN
      $<>"Y" THEN 540
  560 INPUT "ENTER INDEX OF
      CHARACTER DESIRED,ANY
      '-' VALUE FOR MOST REC
      ENTLY DEFINED":NOS
  570 IF NOS<0 THEN 580 ELSE
       C$=CHA$(NOS):: NXX=NO
      S :: GOTO 590
  580 NXX=NS-1
  590 M=16 :: IF LEN(C$)=0 T
      HEN C$=RPT$("0",64)::
      F=0 ELSE F=1
  600 IF LEN(C$)=16 THEN C$=
      C$&RPT$("0",48)
  610 N=1 :: C1$=SEG$(C$,1,1
      6):: C2$=SEG$(C$,17,16
      ):: C3$=SEG$(C$,33,16)
      :: C4$=SEG$(C$,49,16)
  620 PRINT "USE ARROW KEYS
      AND 'W,R,C,Z' TO MOVE
      CURSOR,OR TO CHANGE PO
      LARITY USE'F'FOR DARK
      AND 'A'FOR LIGHT."
  630 CALL KEY(0,K,S):: IF S
      =0 THEN 630
  640 CALL CLEAR :: CALL HCH
      AR(4,4,30,M+2):: CALL
      HCHAR(M+5,4,30,M+2)
  650 CALL VCHAR(5,4,30,M)::
       CALL VCHAR(5,M+5,30,M
      ):: X,Y=5
  660 IF AN$="Y" THEN GOSUB
      1110
  670 IF NXX>=0 THEN DISPLAY
       AT(2,1):ID$(NXX):: DI
      SPLAY AT(22,1):C$
  680 CALL HCHAR(X,Y,30,1)::
       CT$=C$ :: GOSUB 970 :
      : C$=CT$
  690 CALL KEY(1,K,S)
  700 IF S=0 THEN 690 ELSE I
      F N=1 THEN CALL HCHAR(
      X,Y,33,1)ELSE CALL HCH
      AR(X,Y,32,1)
  710 IF K=1 THEN N=0
  720 IF K=12 THEN N=1
  730 IF K=5 AND X>5 THEN X=
      X-1
  740 IF K=0 AND X<M+4 THEN
      X=X+1
  750 IF K=2 AND Y>5 THEN Y=
      Y-1
  760 IF K=3 AND Y<M+4 THEN
      Y=Y+1
  770 IF K=4 AND X>5 THEN IF
       Y>5 THEN X=X-1 :: Y=Y
      -1
  780 IF K=6 AND X>5 THEN IF
       Y<M+4 THEN X=X-1 :: Y
      =Y+1
  790 IF K=15 AND X<M+4 THEN
       IF Y>5 THEN X=X+1 ::
      Y=Y-1
  800 IF K=14 AND X<M+4 THEN
       IF Y<M+4 THEN X=X+1 :
      : Y=Y+1
  810 IF K=18 THEN 900
  820 IF X>4 AND X<13 THEN I
      F Y>4 AND Y<13 THEN P=
      1 ELSE P=3 ELSE IF Y>4
       AND Y<13 THEN P=2 ELS
      E P=4
  830 IF P=1 THEN XO=X-5 ::
      YO=Y-5 :: CH$=SEG$(C$,
      1,16)
  840 IF P=2 THEN XO=X-13 ::
       YO=Y-5 :: CH$=SEG$(C$
      ,17,16)
  850 IF P=3 THEN XO=X-5 ::
      YO=Y-13 :: CH$=SEG$(C$
      ,33,16)
  860 IF P=4 THEN XO=X-13 ::
       YO=Y-13 :: CH$=SEG$(C
      $,49,16)
  870 CT$=CH$ :: GOSUB 970 :
      : CH$=CT$
  880 IF P=1 THEN C1$=CH$ EL
      SE IF P=2 THEN C2$=CH$
       ELSE IF P=3 THEN C3$=
      CH$ ELSE C4$=CH$
  890 CALL HCHAR(X,Y,30,1)::
       C$=C1$&C2$&C3$&C4$ ::
       GOTO 690
  900 DISPLAY AT(22,1):"ENTE
      R SPRITE NAME." :: DIS
      PLAY AT(23,1):"" :: DI
      SPLAY AT(24,1):""
  910 ACCEPT AT(23,1):ID$(NS
      )
  920 IF TP$="N" THEN GOTO 9
      65
  930 DISPLAY AT(22,1):"WANT
       TO COPY ON T.P.(Y/N)?
      " :: ACCEPT AT(23,1):A
      N$
  940 IF AN$="N" THEN GOTO 9
      65 ELSE IF AN$<>"Y" TH
      EN 930
  950 DISPLAY AT(2,1):ID$(NS
      ):: DISPLAY AT(22,1):C
      $
  960 CALL SCREEPT
  965 RETURN
  970 REM SUB ADDPIX(X,Y,N,C
      $)
  990 IF YO<4 THEN ZT=2*XO+1
       :: YTO=3-YO ELSE ZT=2
      *XO+2 :: YTO=7-YO
 1000 A2$=SEG$(CT$,ZT,1)
 1010 IF ZT>1 THEN A1$=SEG$
      (CT$,1,ZT-1)
 1020 IF ZT<16 THEN A3$=SEG
      $(CT$,ZT+1,16-ZT)
 1030 NH=ASC(A2$):: IF NH<=
      57 THEN NH=NH-48 ELSE
       NH=NH-55
 1035 ZZ=INT(NH/(2^YTO))-2*
      INT(NH/(2^(YTO+1)))
 1040 IF ZZ=0 AND N=1 THEN
      NH=NH+2^YTO
```

Continued on p. 45

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Tunnels . . . from p. 28

includes gold, weapons, armor, and magic items such as scrolls, lanterns, and wands. There are also magic fountains to drink from, and living statues that (for a price) can explain the uses of the magic items you carry. Many treasures are scattered about the dungeon, but vaults and chests hold greater stores. Watch out for booby traps!

In *Quest of the King* (included with the *Tunnels of Doom* cartridge) you brave all these hazards to rescue your King. He has been captured by the monsters, and imprisoned in an airtight vault in the lowest level of the dungeon (which can be from the first to the tenth, depending on what you've keyed in at the beginning of the game). Your party of one to four adventurers has only a limited amount of time to save him and his Rainbow Orb of Power, which is also in danger of destruction.

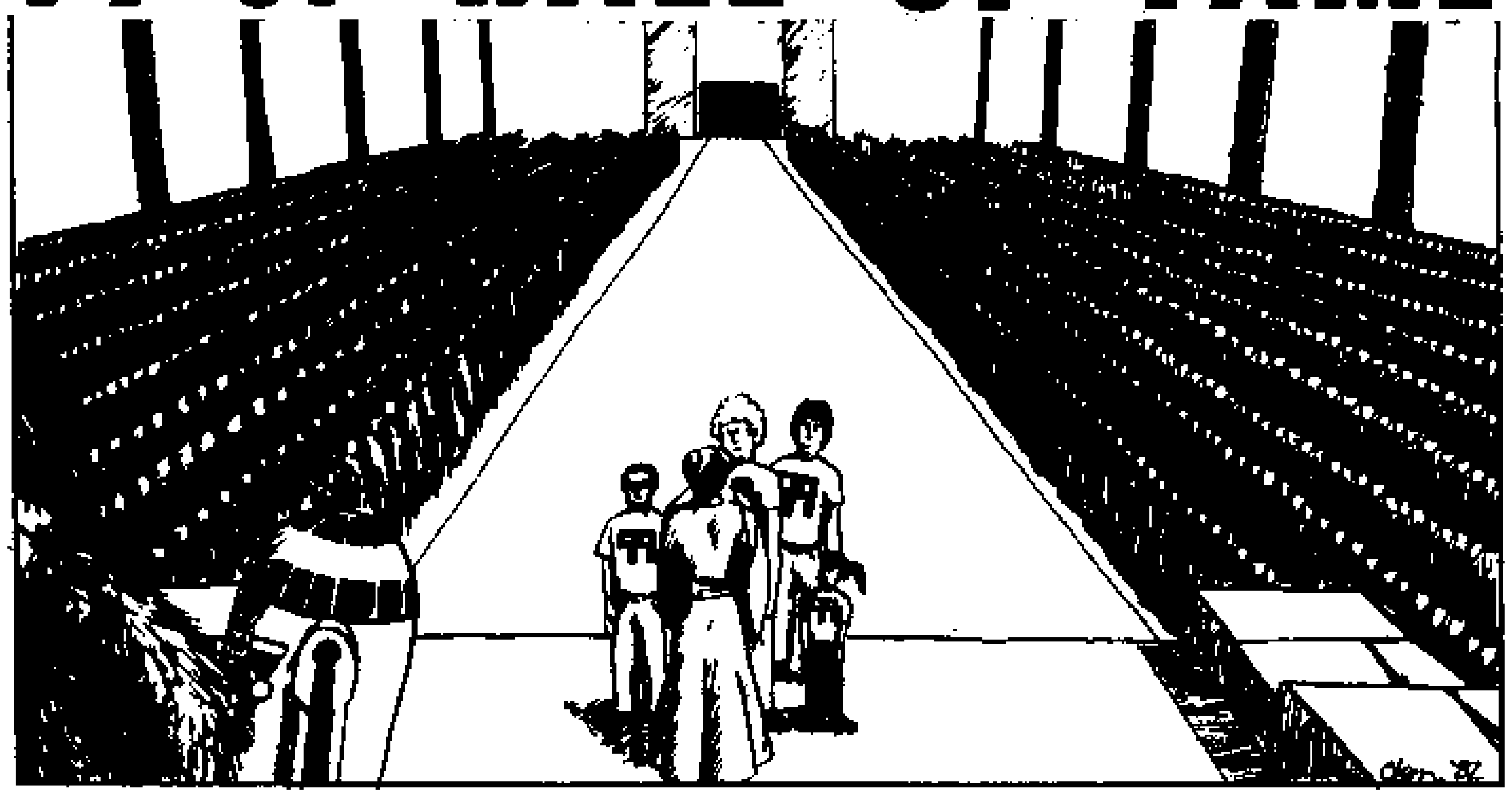
The other game included with the *Tunnels of Doom* cartridge, *Pennies and Prizes*, is a simpler game suitable for young children (who would find full-scale adventures too much to handle). In this game, there are no monsters and no time limit; no dangers at all, in fact. You go into a one- to four-level dungeon in search of eight objects ranging from a puppy to stardust. Additional riches can be received by finding pennies along the way. The game is won when all eight quest objects have been discovered. This is also a good introductory game for learning the basic keystrokes of *Tunnels of Doom* without fear of repeatedly losing your (game) "life."

In short, *Tunnels of Doom* belongs on every armchair adventurer's gameshelf. The combinations and permutations in the two included games are virtually endless, so you will be eager to play again and again. Unlike many fantasy games, this one has full graphics and the ability to handle a party of more than one. The forthcoming series of tape or disk scenarios will be hard-pressed to improve upon the initial offering.

Oh yes—I rescued the King this time. But tomorrow is another day . . .

The Texas Instruments *Tunnels of Doom* Command Cartridge with two adventures (on tape PHM3042T or disk PHM3042D) are available for the suggested retail price of $59.95.

99'er HALL OF FAME



Name: Chery Whitelaw (of North Salt Lake, UT)
Game: Munch Man
Score: 178,950 (43rd screen with "Ghost Hoonos")

Name: Steven Shaw (of Great Britain)
Game: Pinball (Video Games I)
Score: 10,028,010 (verified by screen photo!)

The following were submitted, but without verification. So we cannot induct these submittees into the Hall of Fame at this time.

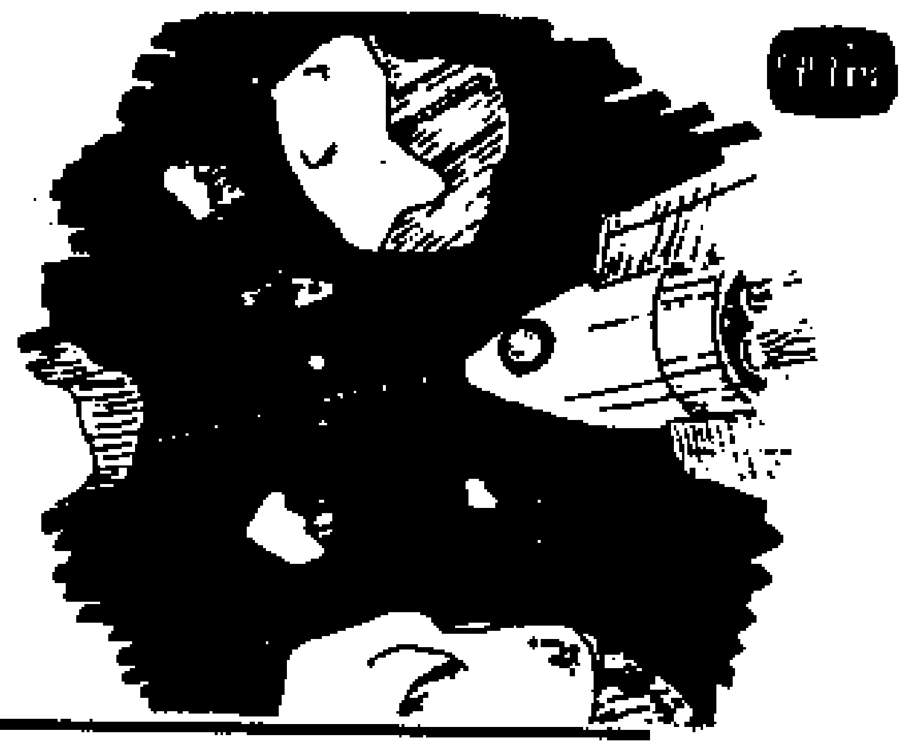
Name: Bryan Lewis (age 16)
Game: Tombstone City (level one)
Score: 459,000 (day 47)

Name: Scott Savage
Game: Car Wars
Score: 39,270 (5th board with 3 computer cars)

Destroyer . . . from p. 29
in Extended BASIC and requires the Extended BASIC module plus joysticks. The second version in Assembly Language requires the Extended BASIC module and Expansion Memory (either joysticks or keyboard will work). If you have the TI Disk Drive Controller and a disk drive, order the game on diskette. This version will automatically maintain the past high scores with player's initials for you—just like the games in the video arcades do. The disk version can also *automatically* decide which of the two language versions your system configuration can run!

The graphics in the Extended BASIC version are not very pleasing because they are so large. This probably wouldn't have bothered me very much if I had not played the super Assembly language version first.

I think you will like this game but it may be hard to get a chance to play the game if you have "video kids" at home.



DEFEND THE CITIES

Reviewed by W. K. Balthrop

Author:	**Jerry Spacek**
Program type:	**Arcade "Repulse-Attacking-Aliens Type"**
Language:	**Extended BASIC or Assembly**
Distributor:	**Intersoft** **5407 Salem Hill** **Austin, TX 78745**
Price:	**$19.95, cassette**

I found myself perched high atop one of New York's tallest skyscrapers. There I was nervously waiting for the expected alien attack to begin. My job was to command one of the new building-launched interceptor ships. Our mission: to detonate falling bombs and to eliminate at whatever cost, the attacking ships.

Since there weren't many of us skilled "city pilots" around, I was supposed to be teleported to Los Angeles to help the West Coast defense team *if* I survived the five fierce attacking ships attempting to make sauce out of the Big Apple . . .

Well, I did somehow manage to save NY and LA, and expected a big ticker-tape parade . . . but those downright nasty aliens knew otherwise: Three more cities had to be successfully defended before I could hang up my uniform and rejoice in the knowledge that Earth was safe.

Two versions of *Defend The Cities* are available. The first version is written in TI Extended BASIC. The second version is written in 9900 Assembly Language to be used with either the Mini-Memory cartridge, or Expansion Memory peripheral box or card in conjunction with the Editor/Assembler cartridge.

If you have Extended BASIC, you'll find this one of the better games being offered in the arcade catagory. The game makes good use of sprites and graphics to keep you interested. *Defend The Cities* can be played with the keyboard or joystick. The joystick is suggested, however, because the action is a little difficult to control on the keyboard.

Intersoft has somehow gotten around one of the biggest problems in the use of sprites with Extended BASIC. Normally, sprite coincidence is very difficult to check because of the slowness, but this game uses fairly fast sprites and makes very few mistakes when checking for hits.

One problem I ran into while playing the game was the slow response to keyboard input when moving or firing. I often found myself colliding with an alien while waiting for the keyboard to be scanned—with the result that the game would end prematurely.

The Mini-Memory assembler version of *Defend The Cities* can be loaded from its cassette tape and stored in the Mini-Memory cartridge for instant use. With this more sophisticated implementation, the original Extended BASIC ver-

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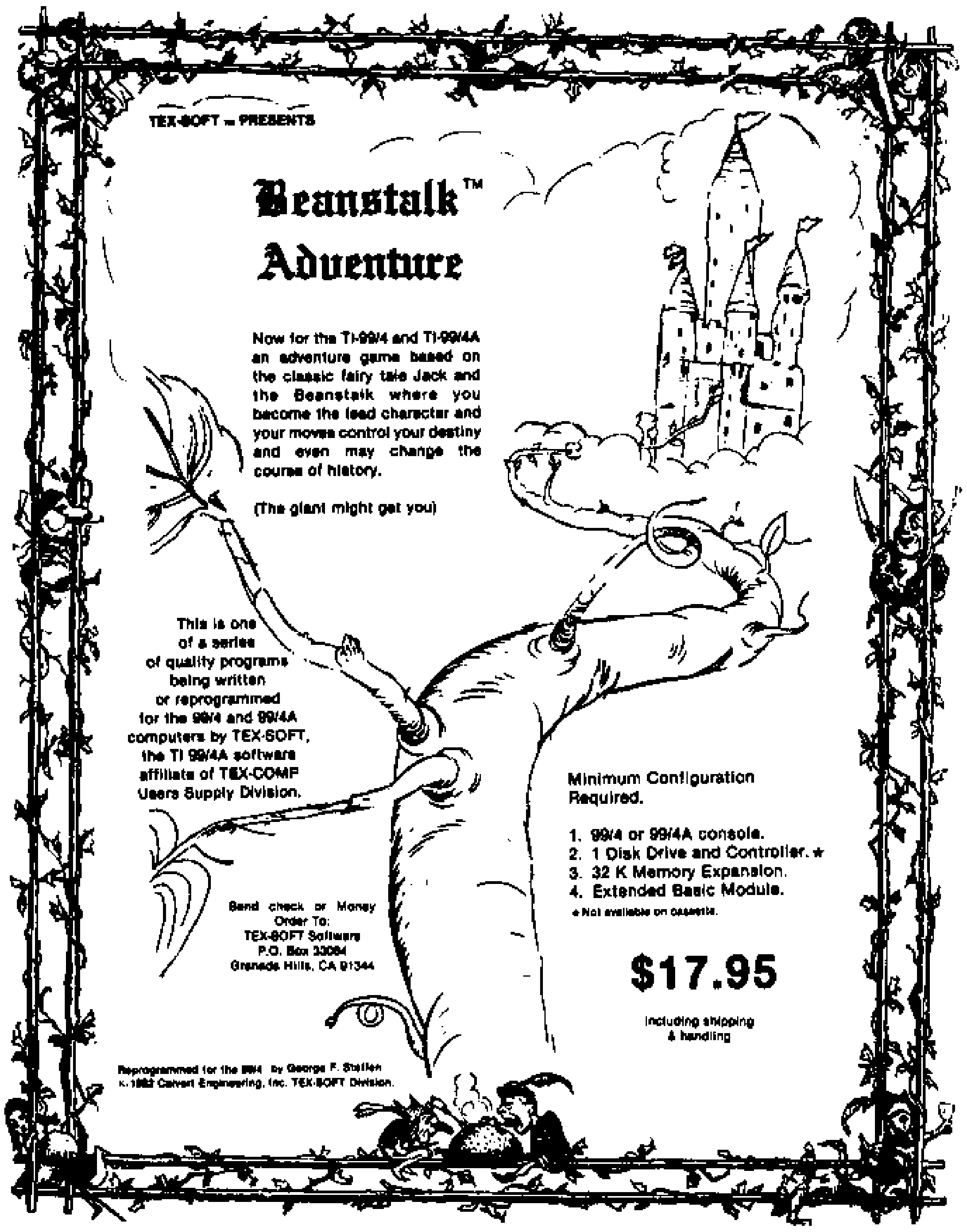

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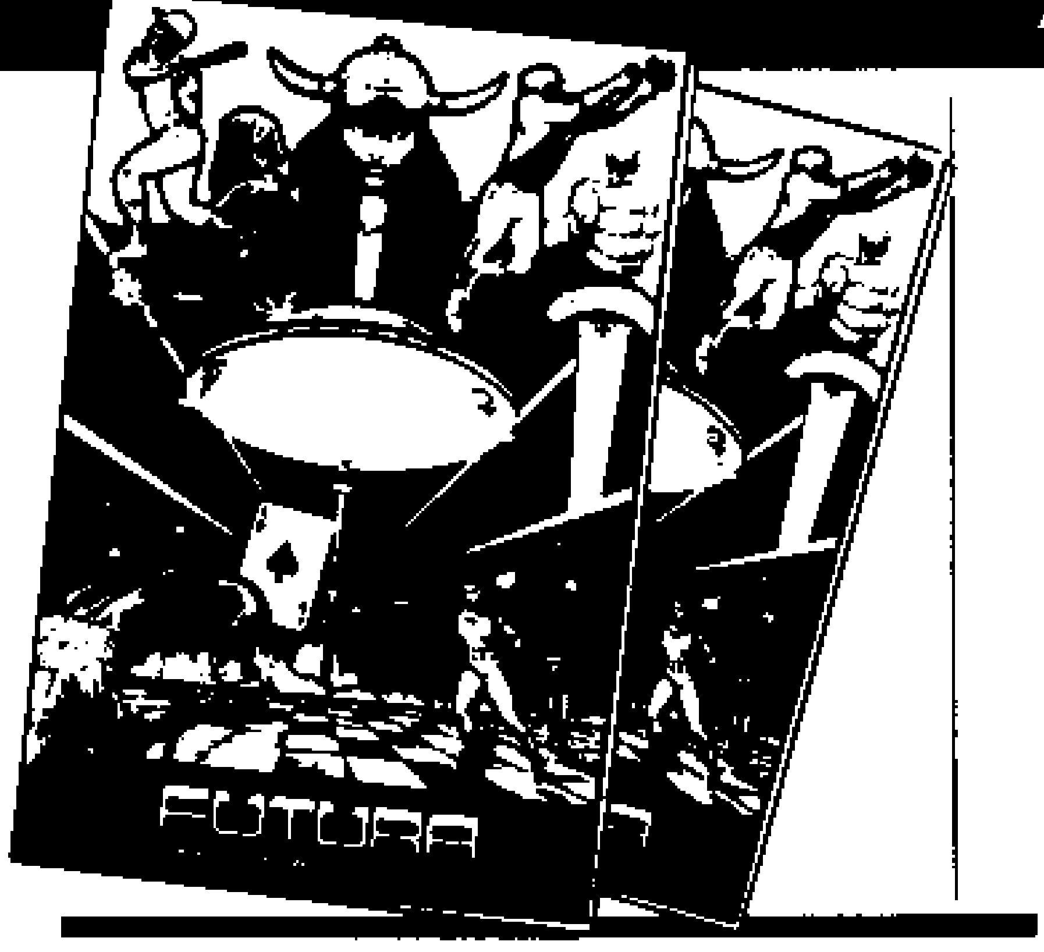

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sion has been transformed into the kind of game you might pump quarters into all day at a commercial arcade. The game scenario is identical, but the action is much faster. The key response is almost instantaneous, and errors are nonexistant in checking for hits, or collisions. If this is a sample of programs to come that can fit into and be run from the Mini-Memory cartridge, you will find this TI Command Cartridge (suggested retail, $99.95) a great investment.

I did encounter a couple of inconveniences with both versions. One was that the player's ship can wrap around the screen. Due to inexperience in ship handling, the ship will occasionally wrap around the bottom or top of the screen, placing the ship off screen for a period. You can't fire from there and it sometimes takes awhile to find your way back into action.

The second inconvenience encountered was when a player's ship is left drifting out of control each time the alien releases a bomb. After the bomb is dropped, control returns and the play continues. The problem arises when your ship drifts into a bomb or the alien ship just as play resumes—making the game come to an "unfair" finish. I felt like the aliens had cheated.

One really super feature in the Mini-Memory version of *Defend The Cities* is that the high score is automatically saved in the module. If you ever want to prove to your brother-in-law or friend down the street that you really *did* score two trillion points, just take your Mini-Memory Cartridge to his house, plug it into his TI Home Computer, and there on his screen will be your intimidating score!

The documentation for "Defend The Cities" is contained in a nine page pamphlet. The start up procedures and rules are well written and easy to understand.

Overall, this was a rather enjoyable arcade game which should have a large appeal to players of all ages.

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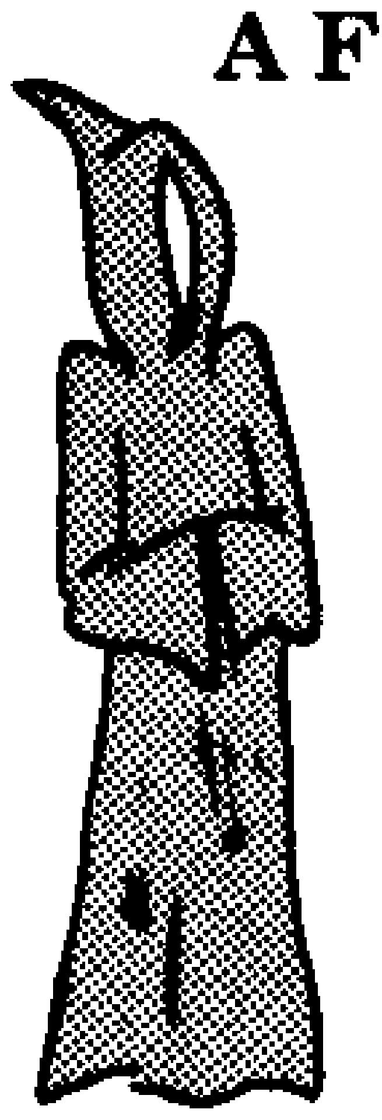

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Spriter . . . from p. 41

```
1050 IF ZZ=1 AND N=0 THEN
     NH=NH-2^YTO
1060 IF NH<=9 THEN A2$=STR
     $(NH)ELSE A2$=CHR$(NH
     +55)
1070 IF ZT=16 THEN CT$=A1$
     &A2$
1080 IF ZT=1 THEN CT$=A2$&
     A3$
1090 IF ZT<>16 AND ZT<>1 T
     HEN CT$=A1$&A2$&A3$
1100 RETURN
1110 REM SUB EXPANDER(C$,X
     O,YO)
1120 DEF B(A)=INT(NHF/(2^A
     ))-2*INT(NHF/(2^(A+1)
     ))
1130 FOR IW=0 TO 15 :: FOR
      JW=0 TO 15
1140 IF JW>7 THEN JWO=JW-8
      ELSE JWO=JW
1150 IF IW>7 THEN IWO=IW-8
      ELSE IWO=IW
1160 IF IW<8 THEN IF JW<8
     THEN LW=1 ELSE LW=3 E
     LSE IF JW<8 THEN LW=2
      ELSE LW=4
1170 IF JWO<4 THEN ZW=2*IW
     O+1 :: YW=3-JWO ELSE
     ZW=2*IWO+2 :: YW=7-JW
     O
1180 SA2$=SEG$(S$,ZW,1)
1190 SA2$=SEG$(C$,ZW+16*(L
     W-1),1)
1200 NHF=ASC(SA2$):: IF NH
     F<=57 THEN NHF=NHF-48
      ELSE NHF=NHF-55
1210 IF B(YW)=1 THEN CALL
     HCHAR(X+IW,Y+JW,33,1)
1220 NEXT JW :: NEXT IW
1230 RETURN
1280 REM SUB CASTER(@FILE$
     ,N,I$(),C$())
1290 OPEN #2:@FILE$,INTERN
     AL,INPUT ,FIXED 128 :
     : GOTO 1300
1300 INPUT #2:NAM$,NS
1310 FOR I=0 TO NS
1320 INPUT #2:ID$(I),CHA$(
     I):: NEXT I :: CLOSE
     #2
1330 N3=23 :: N1=0 :: IF N
     S<=24 THEN N2=NS ELSE
      N2=23
1340 FOR I=N1 TO N2 :: IF
     I>NS THEN 1390
1350 PRINT I;ID$(I):: NEXT
      I
1360 PRINT "PRESS ANY KEY
     TO CONTINUE."
1370 CALL KEY(0,K,S):: IF
     S=0 THEN 1370
1380 IF NS>N3 THEN N1=N1+2
     4 :: N2=N2+24 :: N3=N
     3+24 :: GOTO 1340
1390 RETURN
1430 SUB SCREEPT
1440 OPEN #255:"TP.U.E.S",
     OUTPUT :: FOR X=1 TO
     24 :: S$=""
1450 FOR Y=1 TO 32 :: CALL
      GCHAR(X,Y,Z):: S$=S$
     &CHR$(Z)
1460 NEXT Y :: PRINT #255:
     S$ :: NEXT X :: CLOSE
      #255
1470 SUBEND
```

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Dump . . . from p. 25 Listing 1 cont.

```
ADDR   LABEL   OPCODE   OPERANDS    COMMENTS
----   -----   ------   ---------   --------
               LI       1,E2        PUT CODE FOR CARRIAGE RTN &
               LI       2,4         8/72" VERTICAL LINE SPACING
               BLWP     @>6028      IN DATA BUFFER
               MOV      6,@>8356    POINT TO DEVICE NAME LENGTH
               BLWP     @>6038      DSRLNK-CHANGE VERT SPACING
               DATA     8
               LI       10,50       DELAY
               DEC      10
               JNE      $-2
7D8C           CLR      9           R9->NEXT SCREEN POSITION
       L0      MOV      9,0
               BLWP     @>602C      PUT BYTE OF SCREEN RAM IN R1
               SRL      1,8         SHIFT TO LSB OF R1
               AI       1,-128      ADJUST FOR BASIC
               SLA      1,3         *8
               AI       1,1024      PTRN ADDR=1024+(CHAR#-32)*8
               MOV      1,0
               LI       1,IN
               LI       2,8
               BLWP     @>6030      PUT PATTERN INTO IN
               LI       5,128       R5 = BIT#
               CLR      8           R8 = OFFSET FOR DO
7DB4   L3      LI       6,128       R6 = BYTE#
               CLR      3           R3 = OFFSET FOR IN
               CLR      4           R4 IS FOR BUILDING NEXT CHAR
       L2      CLR      7
               MOVB     @IN(3),7    R7 HOLDS BYTE BEING DECODED
               SWPB     7           PUT BYTE IN LSB OF R7
               C        7,5         IS BIT ON?
               JLT      L1          NO
               A        6,4         YES, TURN OUTPUT BIT ON
               S        5,7         TURN OFF INPUT BIT
               SWPB     7           PUT BYTE IN MSB OF R7
               MOVB     7,@IN(3)    REWRITE TO IN
7DD2   L1      INC      3           POINT TO NEXT INPUT BYTE
               SRA      6,1         /2
               JGT      L2          DO NEXT BYTE, IF MORE
               SWPB     4           PUT OUTPUT BYTE IN MSB OF R4
               MOVB     4,@DO(8)    STORE AT DO
               INC      8           POINT TO NEXT BYTE OF DO
               SRA      5,1         /2
               JGT      L3          CONSTRUCT NEXT OUTPUT BYTE
               LI       0,>1D05
               LI       1,>0400
               BLWP     @>6024      PUT LENGTH OF 4 IN PAB
               LI       0,>1E00
               LI       1,E1
               LI       2,4
               BLWP     @>6028      PUT ESC K SEQ. IN DATA BUFF
               LI       6,>1D09
               MOV      6,@>8356    POINT TO DEVICE NAME LENGTH
               BLWP     @>6038      DSRLNK TO WRITE ESC K SEQ.
               DATA     8
               LI       10,50       DELAY
               DEC      10
               JNE      $-2
               LI       0,>1D05
               LI       1,>0800
```

Continued on p. 48

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Dump . . . from p. 46 Listing 1 cont.

```
ADDR   LABEL  OPCODE   OPERANDS     COMMENTS
----   -----  ------   --------     --------
              BLWP     @>6024       PUT LENGTH OF 8 IN PAB
              LI       0,>1E00
              LI       1,DO
              LI       2,8
              BLWP     @>6028       PUT DO INTO DATA BUFFER
              MOV      6,@>8356     POINT TO DEVICE NAME LENGTH
7E36          BLWP     @>6038       DSRLNK TO OUTPUT 8 CHARS
              DATA     8
              LI       10,50        DELAY
              DEC      10
              JNE      $-2
7E44          INC      9            POINT TO NEXT SCREEN POSN
              CI       9,767        DONE WITH SCREEN YET?
              JGT      L4           YES
              CZC      @MK,9        NO.  ARE WE AT END OF LINE?
              JNE      L0           NO-DO NEXT SCREEN CHARACTER
              LI       0,>1D05      YES-OUTPUT CR LF
              LI       1,>0200
              BLWP     @>6024       PUT LENGTH OF 2 IN PAB
              LI       0,>1E00
7E62          LI       1,CR
              LI       2,2
              BLWP     @>6028       PUT CR LF INTO DATA BUFFER
              MOV      6,@>8356     POINT TO DEVICE NAME LENGTH
              BLWP     @>6038       DSRLNK TO OUTPUT CR LF
              DATA     8
7E78          LI       10,50        DELAY
              DEC      10
              JNE      $-2
              JMP      L0           DO NEXT SCREEN CHARACTER
7E82   L4     LI       0,>1D00      COME HERE WHEN FINISHED DUMP
              LI       1,>0100
              BLWP     @>6024       PUT CLOSE OP CODE IN PAB
              MOV      6,@>8356     POINT TO DEVICE NAME LENGTH
              BLWP     @>6038       DSRLNK TO CLOSE PRINTER
              DATA     8
              LI       10,50        DELAY
              DEC      10
              JNE      $-2
7EA0          MOVB     @S1,@>9C02
*                                   RESTORE SAVED DATA TO GRMWA
              SWPB     @S1
              MOVB     @S1,@>9C02
```

Continued on p. 75

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T.M.

LOGO TIMES

THE
MAGAZINE
OF
THE
LOGO
LANGUAGE

Introduction

LOGO Times is an information resource for anyone interested in participating in the creation of their own *personal* language — one that will easily allow them to communicate with a computer in a totally new audiovisual realm of applied imagination, exploration, and self-discovery. The articles on these pages concern the use of the new TI LOGO language, but readers, however, do *not* need any additional software or equipment (or even a computer) to understand and learn from the material presented here.

If readers want to actually *experience* a TI LOGO environment, they will need either a TI-99/4 or TI-99/4A computer, the Expansion Memory peripheral, and the TI LOGO Command Module. A disk drive, although convenient to have, is *not* required; a user's work may alternately be saved on cassette tape, printed out on the TI Thermal Printer, or hand copied into a notebook (for later re-keyboarding).

In each issue, one or more of the articles may reference or build upon the topics discussed in a previous article. It is therefore recommended that for maximum benefit and understanding, new readers obtain the appropriate back issues of *99'er Magazine* in which the *LOGO Times* articles are contained.

Notice

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Why do you suppose that people who have programmed in LOGO are so enthusiastic about the language? Yes, it is *partly* because of the geometric objects, such as the turtle and sprites, which can be controlled so easily. But these things *aren't* unique to LOGO. Rather, I believe that the really big reason for this enthusiasm is that good programs are, in fact, *easy* to write in LOGO—programs with style.

Like LOGO, ideas in the Pascal language are expressed using procedures. Both languages also foster good programming. But Pascal's syntax is much more complex, and writing even short programs is tedius.

BASIC is a good language for writing short programs, but nothing about the language gives us any clue on how to write a readable program (of any complexity). For example, how should one know to use subroutines to give a program a modular and hierarchical structure? Until beginning students of BASIC programming are taught to use subroutines, the way to learn will be to gain experience with procedure-oriented languages, like LOGO or Pascal.

Not so long ago, a person was considered to be a good programmer if he/she could get a computer to do desired tasks. Indeed, we were impressed by anyone who could use a computer at all. But programming methodology has developed to the point that being an uncritical "hacker" is no longer admirable. Now, just about anyone can learn to write programs which are readable and can be expected to work.

In this article, I emphasize the use of LOGO to *design* the solution to a problem, as well as to *code* it. The key idea will be the introduction of procedure names to represent tasks to be done. The remarkable thing about this somewhat obvious idea is that we come up with the LOGO coding while thinking through the solution. To keep things simple, our example solution will use only procedures without parameters. The full power of procedures will thus not even be hinted at, but the resulting program will be easy to translate into BASIC.

Problem: Write a program to simulate an ORACLE—a source of wise counsel. The program should be interactive, and respond "intelligently" to any question. Let us take this to mean that yes/no questions should be answered randomly, and other questions evaded. (A person seeking advice may hope for more, but that is all we will provide.)

Solution: As with any program, ORACLE must have a beginning, middle, and end. Our main procedure might be:

```
TO ORACLE
HELLO
CONVERSE
GOODBYE
END
```

The main procedure sets out our agend
HELLO, CONVERSE, and GOODBY
The implementation of HELLO an
GOODBYE can be as plain or as fanc
as we like. Possibilities:

```
TO HELLO
CS
PRINT [I AM THE ORACLE.]
PRINT [I WILL ANSWER ALL
 QUESTIONS.]
PRINT [ ]
PRINT [AFTER YOUR LAST
 QUESTION,]
PRINT [JUST PRESS ENTER.]
WAIT 120
PRINT [ ]
END

TO GOODBYE
PRINT [ ]
PRINT [THANK YOU FOR
 CONSULTING]
PRINT [THE ORACLE.]
END
```

The middle part, CONVERSE, w
do the work of responding to question
Again, assuming that named tasks ca
be accomplished, we define:

```
TO CONVERSE
PRINT [ ]
PRINT [WHAT IS YOUR
 QUESTION?]
MAKE "X READLINE
IF :X = [ ] THEN STOP
TEST ISQUEST?
IFT REPLY
IFF PRINT [QUESTIONS END
 WITH A "?"!]
WAIT 120
CS
CONVERSE
END
```

Notice that we are supplying only eas
details. Any task which might requi
thought is conceptualized as a ne
procedure.

ISQUEST? should output TRUE
FALSE depending on whether the
sponse is a question. Let's accept as
question any response where the la
character is a "?":

```
TO ISQUEST?
IF LAST LAST :X = "? THEN
 OUTPUT "TRUE ELSE OUTPU
 "FALSE
END
```

The two LASTs are used because w
are checking whether the last characte
of the last word of a list is a "?" Sinc
we are only going to try to distinguis
yes/no type questions, REPLY can b
simply:

```
TO REPLY
IF ISYESNO? THEN YESNO
 ELSE OTHER
END
```

LOGO Has STYLE

By Roger B. Kirchner

We now have to be more specific. The only part of our problem that can be said to require an idea is the method for "recognizing" yes/no questions. The difficult questions begin with words like which, where, what, why, when, will, and how. Observe that very few yes/no questions have a first word beginning with "wh", "wi", or "ho". Let us, then, simply decide to answer any other questions as if it were a yes/no question. This procedure uses FIRST and BUTFIRST (BF):

```
TO ISYESNO?
MAKE “W FIRST :X
MAKE “L1 FIRST :W
MAKE “L2 FIRST BF :W
MAKE “W WORD :L1 :L2
IF MEMBER? :W [WH WI HO]
 THEN OP “FALSE ELSE OP
 “TRUE
END
```

which depends upon:

```
TO MEMBER? :VAL :LIST
IF :LIST = [ ] THEN OUTPUT
 “FALSE
IF :VAL = FIRST :LIST THEN
 OUTPUT “TRUE
OUTPUT MEMBER? :VAL BF
 :LIST
END
```

The hard part having been solved, all that remains is the implementation of YESNO and OTHER, which correspond to the two types of questions. In the versions included in the listings, YESNO answers a question YES 40% of the time, NO 40% of the time, and MAYBE 20% of the time. And OTHER gives one of ten evasive answers, each with a 10% chance.

Our straightforward approach has resulted in a readable, almost self-documenting program. This was possible because LOGO allows us to introduce procedures with names which convey their meaning. Programming in LOGO is so easy it's almost a surprise when it's done.

For fun: Play with ORACLE, and modify it to your taste. The complete LOGO implementation of ORACLE is shown in Listing #1.

Challenge: Rewrite ORACLE in BASIC in such a way that you are confident it will work on nearly the first try. Hint: Use subroutines! Then use LOGO to re-think programs you have worked on before, and see how much your programming improves. It will! (Note: It is almost unfairly easy to translate ORACLE into another language which supports procedures. See *Subprograms in TI Extended BASIC* elsewhere in this issue.)

```
TO HELP
CS
PRINT [TYPE "ORACLE" ]
PRINT [ ]
PRINT [THE ORACLE WILL
ANSWER ]
PRINT [YOUR QUESTIONS. ]
END

TO ORACLE
HELLO
CONVERSE
GOODBYE
END

TO GOODBYE
PRINT [ ]
PRINT [THANK YOU FOR ASKING
THE ]
PRINT [ORACLE. ]
END

TO HELLO
CS
PRINT [I AM THE ORACLE. ]
PRINT [I WILL ANSWER YOUR
QUESTIONS. ]
PRINT [ ]
PRINT [END BY JUST PRESSING
RETURN. ]
WAIT 120
PRINT [ ]
END

TO OTHER
MAKE "R RANDOM
IF :R = 0 THEN PRINT [I CAN'T
ANSWER THAT. ]
IF :R = 1 THEN PRINT [THAT IS
TOO PERSONAL. ]
IF :R = 2 THEN PRINT [YOU
DON'T REALLY WANT TO KNOW. ]
IF :R = 3 THEN PRINT [I DON'T
KNOW. ]
IF :R = 4 THEN PRINT [IT WOULD
NOT BE WISE FOR ME TO ANSWER. ]
IF :R = 5 THEN PRINT [PLEASE
DON'T ASK ME THAT. ]
IF :R = 6 THEN PRINT [I WILL
PASS ON THAT ONE. ]
IF :R = 7 THEN PRINT [ASK THAT
A DIFFERENT WAY. ]
IF :R = 8 THEN PRINT [ASK A
DIFFERENT QUESTION. ]
IF :R = 9 THEN PRINT [I WON'T
TELL YOU THAT. ]
END

TO YESNO
MAKE "R RANDOM
IF :R < 4 THEN PRINT "NO STOP
IF :R > 5 THEN PRINT "YES STOP
PRINT "MAYBE
END

TO REPLY
IF ISYESNO? THEN YESNO ELSE
OTHER
END

TO ISQUEST?
IF LAST LAST :X = "? THEN
OUTPUT "TRUE ELSE OUTPUT "FALSE
END

TO CONVERSE
PRINT [ ]
PRINT [WHAT IS YOUR QUESTION? ]
MAKE "X RL
IF :X = [ ] THEN STOP
TEST ISQUEST?
IFT REPLY
IFF PRINT [QUESTIONS END WITH
A "?"! ]
WAIT 120
CS
CONVERSE
END

TO INIT
CS
PRINT [I WILL ANSWER YOUR
QUESTIONS ]
PRINT [ ]
PRINT [END BY JUST PRESSING
RETURN. ]
WAIT 120
END

TO ISYESNO?
MAKE "W FIRST :X
MAKE "L1 FIRST :W
MAKE "L2 FIRST BF :W
MAKE "W WORD :L1 :L2
IF MEMBER? :W [WH WI HO ]
THEN OP "FALSE ELSE OP "TRUE
END

TO MEMBER? :VAL :LIST
IF :LIST = [ ] THEN OUTPUT
"FALSE
IF :VAL = FIRST :LIST THEN
OUTPUT "TRUE
OUTPUT MEMBER? :VAL BF :LIST
END
```

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Letters on LOGO

Dear Sir:

The enclosed procedures may be of interest to readers as a convenient means of exploring graphic designs associated with periodic motion. The procedures can be used to draw a large number of interesting designs.

Instructions. After loading or typing in the procedures, use the MAKECHAR command to remove the pattern from character 64, the "@". This character is used as a "space" in positioning text.

A design is determined by four parameters. The first two are the X and Y coordinates at which the design is to be started, specified with the SETX and SETY procedures. For starting coordinates of –70 20, one would enter:

```
? SETX –70 SETY 20
```

Next, a size is chosen with the SIZE procedure. A size of 14 would be entered:

```
? SIZE 14
```

The value entered for SIZE should be an even number. Odd numbers will be transformed into the next lowest even number. Finally, an angle is specified and the drawing of the design initiated with the DRAW procedure. To specify an angle of 19 degrees, enter:

```
? DRAW 19
```

Once a parameter value has been specified, it will be retained in subsequent designs unless changed.

The table of values below will serve to illustrate the range of designs which can be produced.

Example Sets of Parameter Values

Starting Position		Size	Angle
SETX	SETY	SIZE	DRAW
–70	20	14	19
–10	20	12	11
–30	20	12	15
–60	20	24	20
–60	0	60	60
–50	–40	126	122
–50	–40	126	179

Parameter values are displayed at the bottom of the screen. If a design begins to repeat, the procedures terminate with the message "DONE." They may be otherwise stopped at any time with the BACK function.

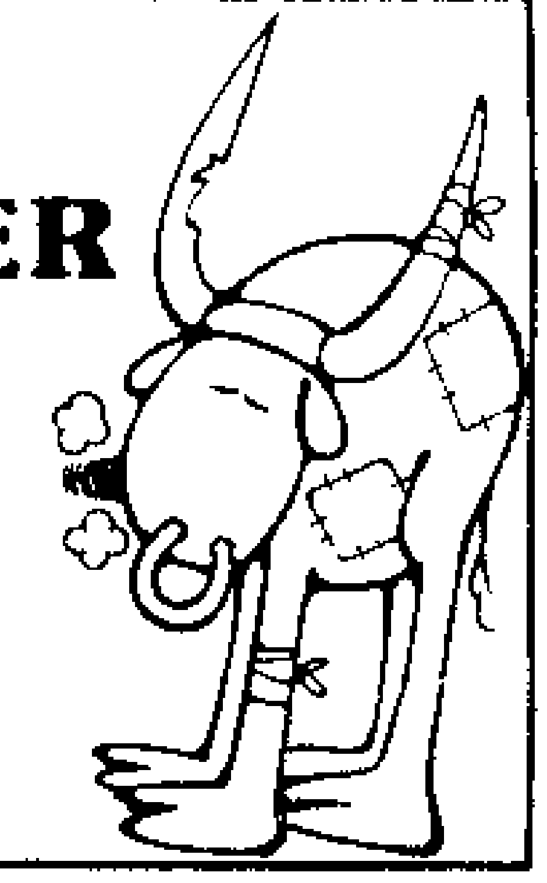
Method. The turtle moves forward by a variable number of steps and then turns right by the number of degrees specified in DRAW. The number of steps the turtle takes varies from 0 to the value of SIZE in increments of 1 and then back to 0 again. The variation in number of steps is controlled by the procedure OSCILLATOR.

If a given size is divided into 90 degrees and the result used as the angle specification, the design is an elipse; and for that reason many of the designs resemble the motion of simple and multiple eliptic pendulums.

I think LOGO is the most exciting development since the introduction of the TI Home Computer, and I'd like to thank you for making it all the more fun through the excellent articles in *LOGO Times.*

John Clulow
Perrysburg, OH

```
TO SETY S
CALL :S "YC
END

TO SETX S
CALL :S "XC
END

TO OSCILLATOR
FD :SIZE + :LENGTH RT :ANGLE
IF :LENGTH < 0 THEN CALL - :LENG
TH "ABSOLUTE ELSE CALL :LENGTH "
ABSOLUTE
TEST :ABSOLUTE > :SIZE - 1 IFT C
ALL - :CHANGE "CHANGE
CALL :LENGTH + :CHANGE "LENGTH
END

TO CYCLE
REPEAT 4 * :SIZE [OSCILLATOR ]
IF NOT XCOR = :XC CYCLE
IF NOT YCOR = :YC CYCLE
IF NOT HEADING = 0 CYCLE
END

TO DRAW ANGLE
TEST THING? "SIZE IFF CALL 7 "SI
ZE
TEST THING? "XC IFF CALL - 30 "X
C
TEST THING? "YC IFF CALL 20 "YC
TELL TURTLE HT CB 4 SC 15 CS SXY
 :XC :YC
TITLE
CALL 1 "CHANGE CALL :SIZE "LENGT
H
CYCLE
PRINT [* * * * * * DONE * * * *
* * ]
END

TO SIZE S
CALL :S / 2 "SIZE
END

TO TITLE
PRINT SENTENCE SENTENCE [@@@@@@D
RAW ] :ANGLE SENTENCE [SIZE ] :S
IZE * 2
PRINT SENTENCE [@@@@@@START AT ]
 SENTENCE :XC :YC
END
** DONE **
```



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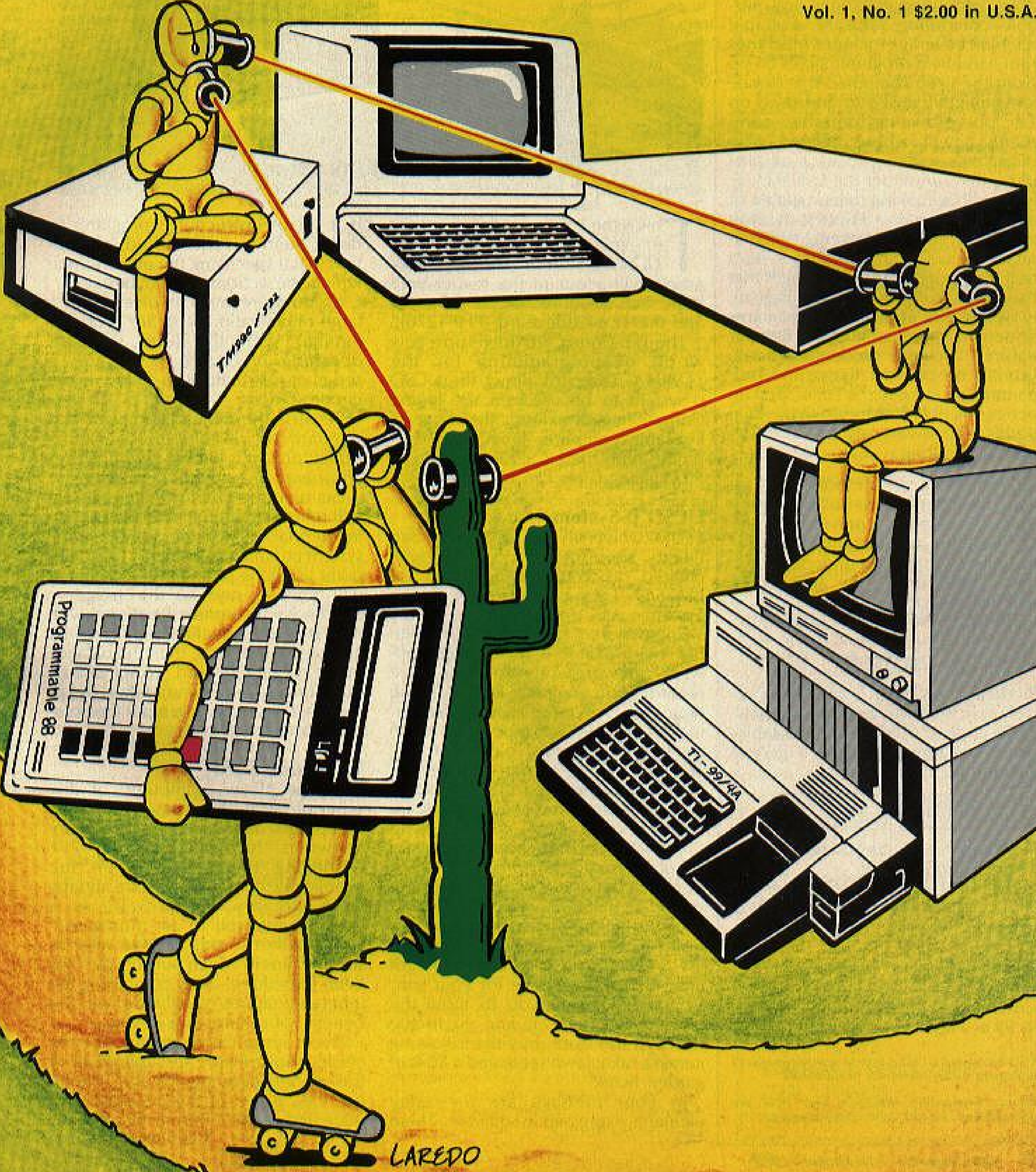
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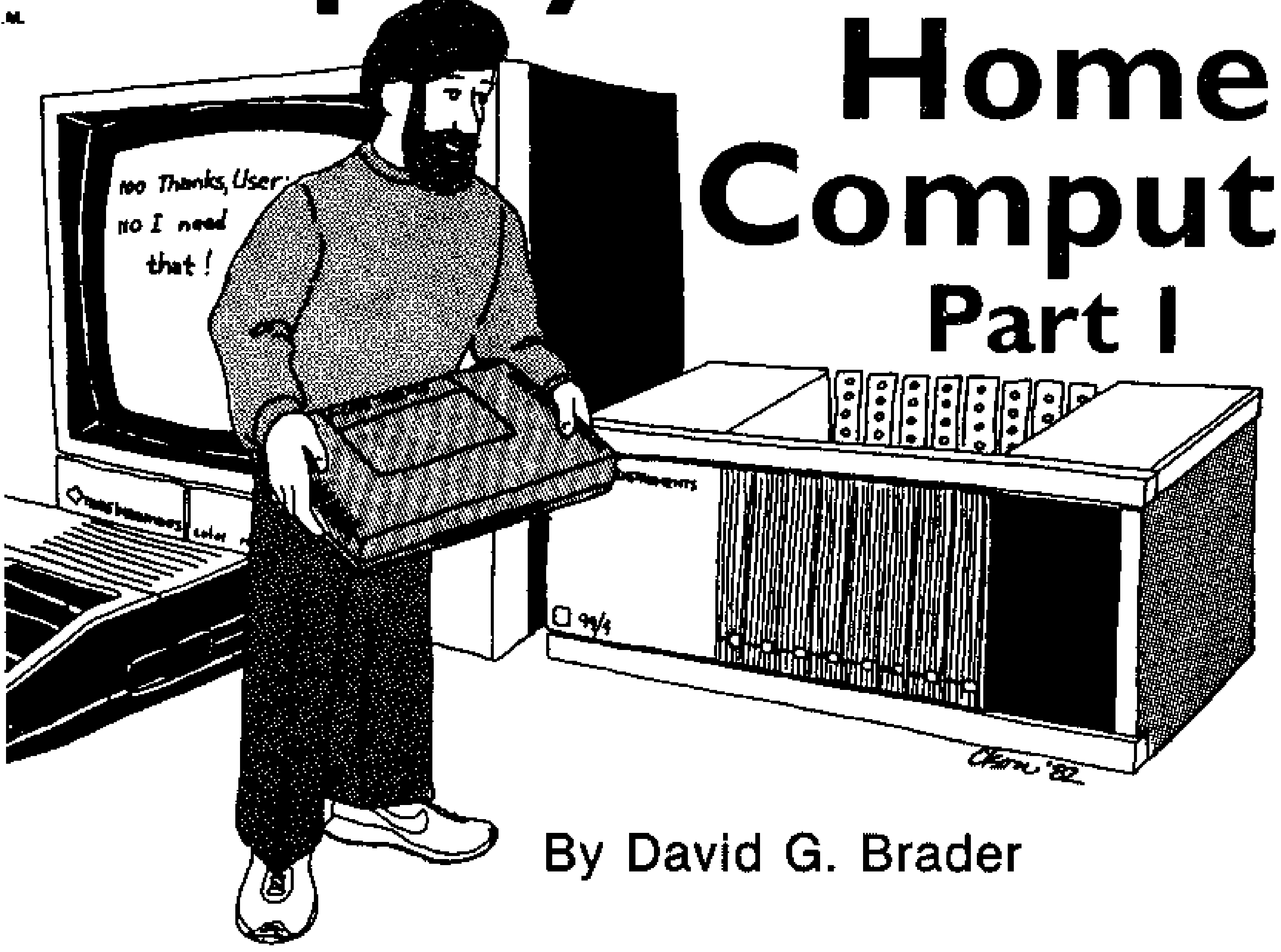
Part I



By David G. Brader

This is the first in a series of articles to explain in layman's terms the UCSD p-System. This particular article will acquaint the reader with basic facts about the UCSD p-System and the TI p-Code Card (PHP1270).

The TI p-Code Card opens up a new world of programming for the TI-99/4A. The card allows the UCSD p-System to be used on the Home Computer, and extends the range of available computer languages. Currently, both the UCSD Pascal and TI PILOT languages can be added.

UCSD p-System

The University of California, San Diego pseudo-code System was created, as you would expect, at U.C.S.D. Let's call it simply the p-System.

The p-System falls into that intangible realm of information called software. Software is similiar to a voice recording on magnetic tape. A *blank* tape and a *recorded* tape appear virtually the same. The tape is just a carrier for the intangible voice recording. Software may be carried on magnetic tapes, and other media, and can also be carried or stored electronically inside of a computer.

Software is, in its simplest terms, a set of instructions or programs directing the computer's actions. Information (data that the computer may perform the actions *on*) is also considered to be in the software catagory.

For example, as a parent you might tape record a message for your son: "Sonny, I want you to mow the lawn, wash the car, and go to the store. At the store, buy the following items: a rake, lawn seed, and a 50-foot garden hose."

In your message are the same elements expressed in software. There is a set of instructions (program) to direct Sonny's actions, and information (data) specifying the objects upon which the actions should be taken.

If you were ever involved with a large organization, you are probably familiar with the term *standard operating procedure* (S.O.P.) as a series of instructions to follow in set circumstances.

Because the p-System software is a standard set of *computer* operating procedures, it is known generically as an *operating system*.

Examine the chart in Figure 1. We will refer to it often in this and following tutorials. It illustrates the operating system commands available to a computer using the p-System. A command will envoke one of the p-System S.O.Ps. Each command is shown with its first letter capitalized, followed by an open parenthesis, then the balance of the command word. To activate an operating system command on the p-System, the user simply types the command's first letter.

TI p-Code Card

A tape player, computer, or any other physical object associated with computers falls into the catagory known as "hardware."

Bridging the gap between the changeable nature of software and the fixed circuitry of hardware is a category referred to as "firmware." We usually use this term to refer to silicon chips in which our software has been imbedded—thus combining the inherent features of software with the benefits of a hardware device.

The p-System is quite large if it includes the software to support all of the operating commands. But, TI took just the "core" of the p-System software and made it into firmware. This

Continued on p. 62

Portable Program Development and the p-System:

An Interview With a Pioneer

In order to better understand the advantages and problems involved with developing portable programs in the UCSD p-System environment, the PCM staff interviewed Michael Hadjioannou, President of TICOM Systems, Inc., a Marina Del Rey, California software development firm that uses the UCSD p-System extensively.

In the course of our interview, we learned that TICOM has used Texas Instruments computers in their development work. TI is the only manufacturer of a full line of computers—from the TI-99/4A Home Computer, to the Business System 200, on up through the 990 board development system, and the big 990 series of minis—that has the UCSD p-System available on each member of its line. We naturally wanted to know how well the TI computers performed.

PCM—*Why and when did TICOM decide to get involved with the UCSD p-System?*

MH—In 1978, in a micro world dominated by BASIC, when the only alternative for portability of structured programs seemed to be the "macro" approach, the UCSD Pascal System began to surface.

Pascal had found its way out of academia in rare commercially supported versions—and there only as a "systems" language. Standard Pascal, although well structured and efficient, left much to be desired as a vehicle for implementing interactive, business applications. A good amount of up-front work was necessary by the developer to provide the support environment that every good BASIC supplied.

The popular high-level languages offered no real choice. Pascal was not perfect but, despite its limitations, it was the one language to offer structuring throughout and minimize the distance from design concepts to program steps.

Pascal was up and thriving at the University of California at San Diego (UCSD) and had been extended to support string operations, random access to files, and interactive I/O. The screen was treated like a video terminal and not like a teletype. System programs acted as if they belonged together rather than resenting the demands each made on the rest. The system was fast. And to top it all off, it could be made to run on any micro!

PCM—*How did you get involved with Texas Instruments hardware?*

MH— Texas Instruments was using Pascal as its systems language. TI's Pascal was another version, also extended—but in other ways and for different reasons. The host environment was DX10, a highly capable, menu-driven operating system for mini-computers. TI had a commitment to Pascal, and had also made a commitment to UCSD to bring the UCSD p-System up on the 9900 processors.

TICOM became a UCSD source licensee and became closely involved with the UCSD and TI efforts to adapt the system on the 9900 family of computers. A lot of work took place before the p-System (version II.0) was fully operational on the TI990 mini-computers, and even on the maverick- but highly-powerful TM990 board systems.

Two parallel Pascal development efforts were launched—one for the UCSD p-System, and one for DX10 Pascal. Both systems needed setup work to provide a complete support environment. After the initial design, with the goal of producing portable Pascal programs, libraries of external procedures and units were implemented for each system. They provided for interactive full screen I/O, comprehensive string operations, generalized file and device interfaces, fast access to text files, program chaining, decimal arithmetic and value formatting.

PCM—*Did you notice any immediate advantages of the p-System?*

MH—After prototypes were brought up on both systems, the advantages of the p-System became obvious. The one-pass compiler, fast editor and linker and the unit library mechanism made the program development cycle an order of magnitude faster when compared to a conventional environment.

While this development was taking place, we completed the implementation of the p-System as a "task" under the DX10 operating system. This made possible a total migration of software within a family of computers—a feat that, even today, only the p-System can perform with such completeness: *Develop on any system, and run on all!*

Eventually, the DX10 Pascal development effort was abandoned since UCSD Pascal could now run on all systems. The p-System, with the proper set of unit libraries, proved quite capable of supporting real-world applications on hardware ranging from a desktop micro to a multi-user mainframe.

PCM—*How did your development effort pay off?*

MH—The effort invested in creating a portable application across two very diverse Pascal support environments turned out to be extremely beneficial. By striving for portability and maximum efficiency, a set of support units evolved that has made later adaptations to new environments a virtually trivial matter.

Going with the p-System in 1978 was a gamble. Today, it is practically a necessity.

PCM—*What are some of the p-System capabilities useful to a person developing software today?*

MH—The p-System offers today's developer a unique environment of integrated and user-friendly modules to carry out the design and implementation of a modern "turnkey" application.

Although a number of languages are (or will soon be) available for use on the p-System, the heart of the system is a highly capable and flexible Pascal compiler and p-code interpreter.

The Pascal language can give structured and controlled access to virtually all functions of the environment. Assembly coding is only necessary for low-level control of devices, or for speeding up crucial bottlenecks in an application. There is a Native Code Generator available that will perform any desired p-code to native code conversion automatically.

In addition to the coordinated set of system modules that help to speed up the development process, there are a number of features built into the Pascal language itself that enhance its power substantially. Some of these are:

Continued on p. 61

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Power in Your Palm:

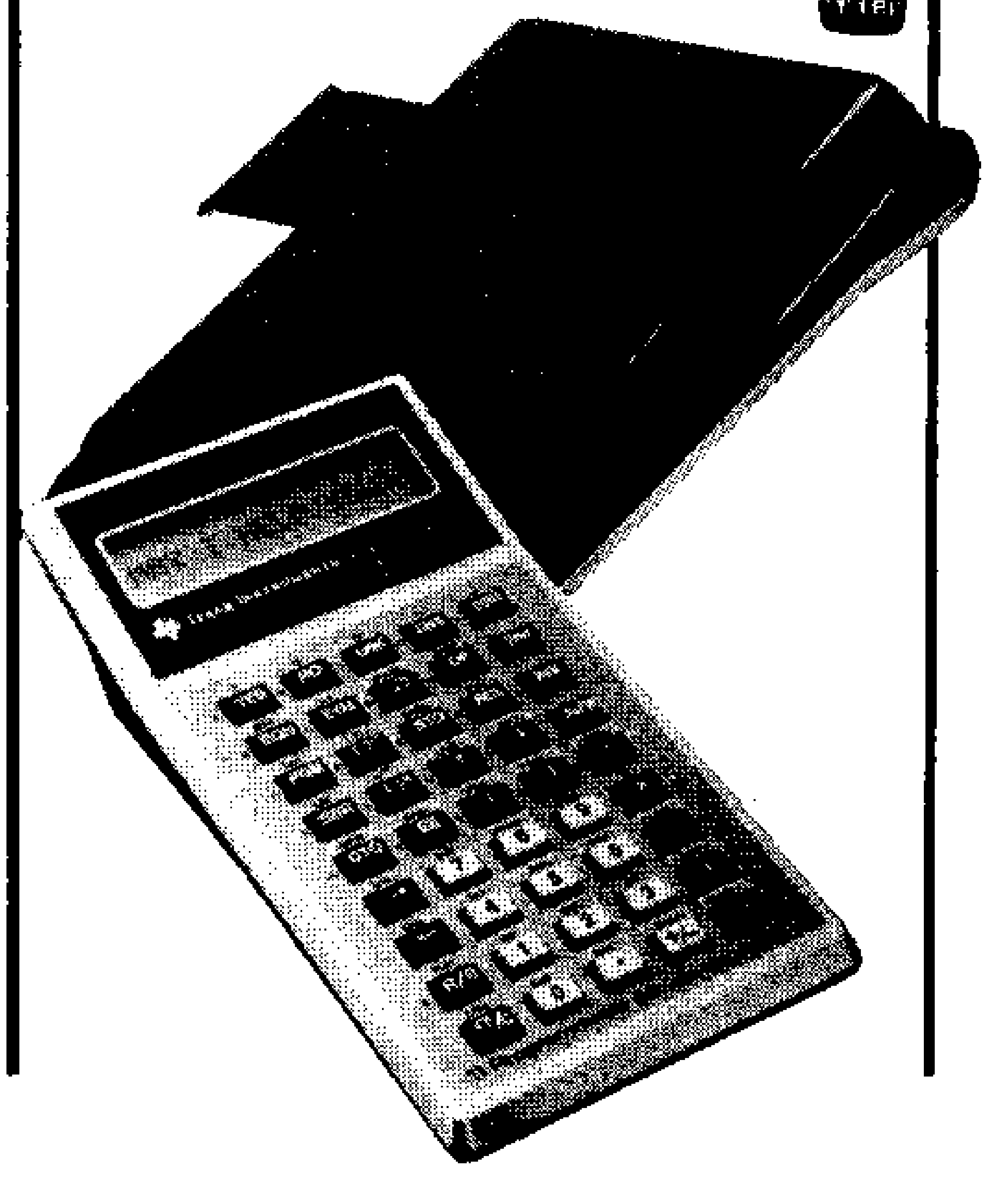
A Brief Encounter with the TI-88

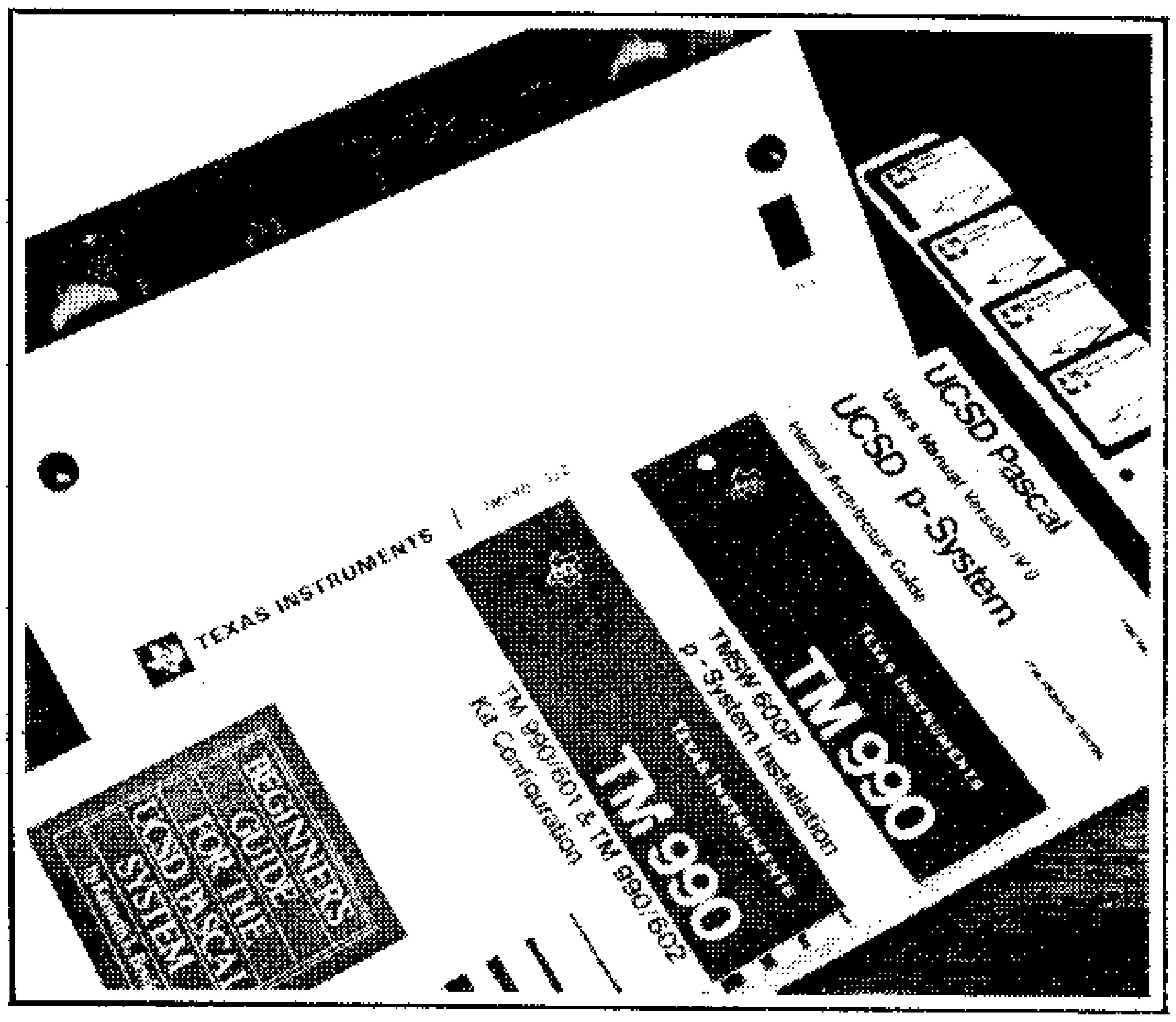
By Walter Hego

We at PCM welcome Texas Instruments to the world of Portable Computing with their introduction of the TI-88 hand-held programmable with its alphanumeric display and preprogrammed Solid State Software™ Library Modules. Programs and data can be saved in Constant Memory™ modules, and can be removed and transported to any other TI-88 or just saved in a pocket for later use. The machine contains a clock, calendar, and alarm system accessible via user programs (in an algebraic language), and a unique prompting system that guides users through the setting of these functions. The prompting system also allows menu paging for selection of user-written or TI Library subroutines and programs—complete with full data input prompting and verification.

PCM feels that this interesting product (whether it ever finds its way to dealer shelves, with the technology leap-frogging so fast . . .) signifies a commitment by TI to portable computing, and suggests that a more versatile, feature-laden machine (with a larger display, text-entry keyboard, BASIC language interpreter, and external video/communications capabilities) can't be too far down the road.

Our preliminary work with the TI-88 indicates that meaningful two-way communications beween the Home Computer and hand-held units is indeed implementable and desirable. Watch PCM for future developments.

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UCSD p-System
TM990
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A Review of the TM990/602 Computer Board System Kit

By David G. Brader

When I first heard that we were going to review the Texas Instruments TM990/602 computer board system *kit*, I was filled with dread. Floating around in my mind was the image of a large crate arriving at our editorial offices, and me having to spend hour upon hour sorting hundreds of resistors, capacitors, and other electronic gadgets. I recalled past experiences constructing electronic kits, and all of the headaches it caused.

"For TI, a *kit* is a factory assembled computer . . . made up of a standard chassis and off-the-shelf components in the form of plug-in circuit boards."

But much to my relief, I found out that *my* old definition of "kit" and the definition that TI was using were indeed worlds apart. For TI, a "kit" is a factory-assembled computer that is made up of a standard chassis and "off-the-shelf" components in the form of plug-in circuit boards.

There are a large selection of TM990 boards available from Texas Instruments. The selection even includes a speech board that uses the same technology as the Home Computer. Other TI TM990 board types include Central Processing Unit (CPU), Random Access Memory (RAM), and disk drive controller.

CPU modules incorporate microprocessor, memory, and I/O on a single board. They come preassembled and pretested—ready to use. The net result is that users are spared much time-consuming planning. For example, all the system interconnects are already determined.

Furthermore, the TM990 100-pin bus is widely recognized. Modules are available from both TI and third-party vendors to expand system features. This capability provides solutions to real-world interfacing problems with a minimum of design for users. You can, for example, purchase an IEEE-488 board to connect up to a wide variety of test equipment or a Winchester hard disk, or even purchase a bubble memory board.

As members of TI's pace-setting 9900 "First Family," these microcomputer modules are based on the family's advanced memory-to-memory architecture. This innovative approach requires fewer instructions to perform a given function. This, in conjunction with a common instruction set, greatly reduces programming time and effort.

The 9900 Family has been structured to provide a mutual compatibility that preserves your software investment and avoids software "migration" expense. This means that you don't have to worry *today* whether your software will still apply as you upgrade components or change applications *tomorrow*. Your risk of software obsolescence is negligible.

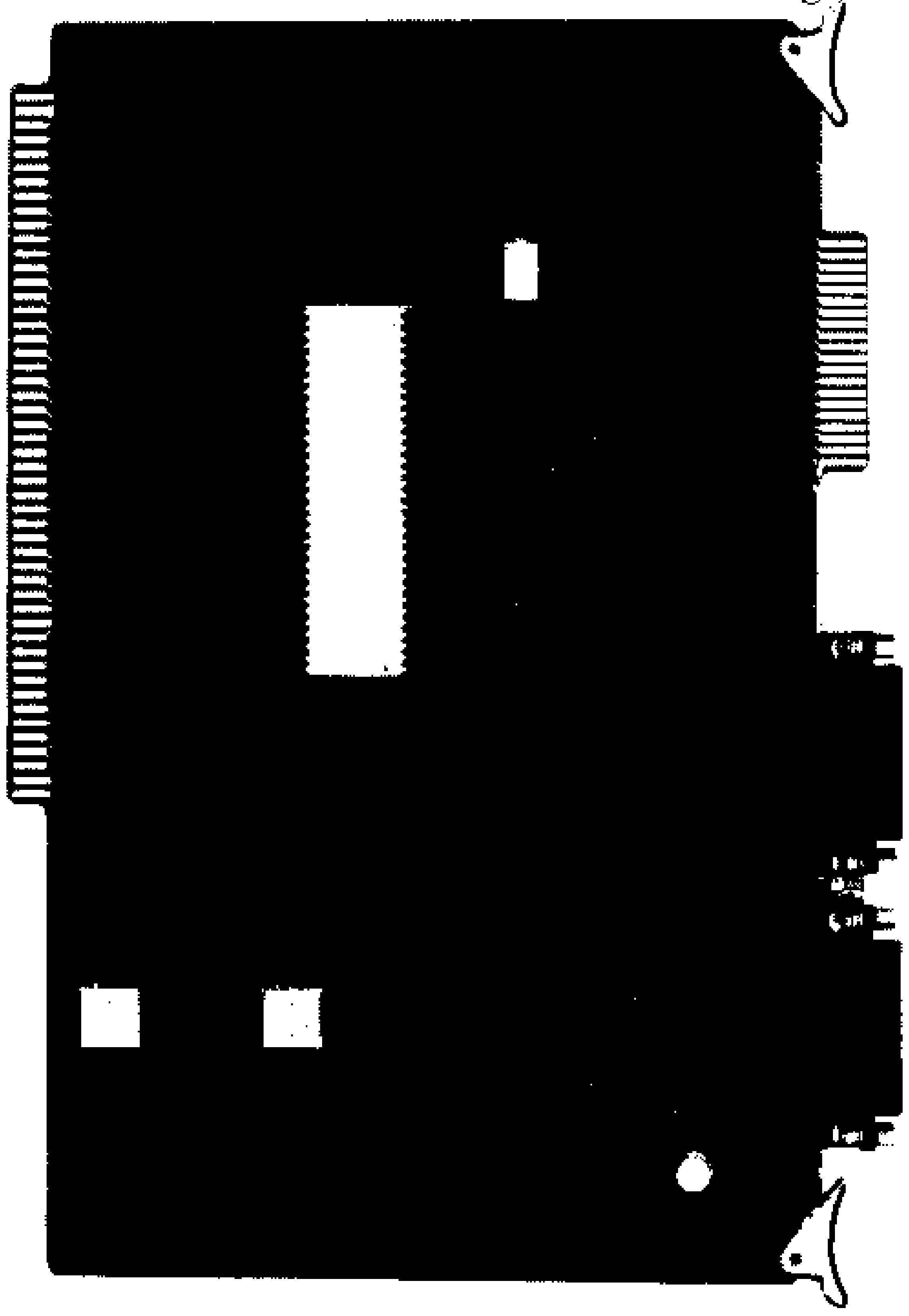
Additionally, TI is committed to the continuation and expansion of the 9900 Family. As your needs change—and as new technologies develop—you can expect to use higher performance CPU modules and more versatile memory modules while continuing to use your original software.

TI memory boards in this series give the designer quite a choice. If the application is in a dedicated task environment, the combination of up to 32K bytes of Erasable Programmable Read Only Memory (EPROM) and up to 16K of static RAM on one board will be of interest. If different applications must be run at various times, the 64K dynamic RAM board gives you that flexibility. Any of the memory boards may be purchased with the minimum of memory chips installed and then expanded at a later date.

We were greatly surprised with the flexibility of the TM990/303A disk controller board. The board is so flexible, that almost any disk configuration can be used with it—up to three 5 1/4 inch drives or up to four 8 inch drives, single or double sided, single or double density, IBM or TI format. It has DMA transfer capability, and even a bootstrap load feature which can be used to intialize the computer from diskette.

Our TM990/602 kit contained three boards one of which was the disk drive controller just mentioned. With it we used two Qume Data-Trak 8" single-sided single-density disk drives.

The main board in the TM990/602 computer is the Central Processing



Unit. In our case, the kit came with a TM990/101MA CPU board installed. There are actually four differently configured CPU boards to choose from.

The TM990/101MA CPU board uses the same microprocessor chip as the TI Home Computer (TMS9900) and has an instruction set compatible with other members of the TI990 family of computers. Other features of this board include the capacity for up to 4K-bytes of EPROM, Direct Memory Access (DMA) to both off-board and on-board memory, a programmable system interface, two serial input/output ports, three programmable internal timers, and edge-triggered interrupt with software reset.

The main memory for the 602 kit is on a TM990/203 memory expansion board. Our version contained the maximum number of dynamic RAM integrated circuits which results in 64K-bytes of memory. A nice feature of this board is the issuing of an interrupt to the CPU upon an error in the memory.

Each of the three boards came with a manual that fully described the board. Included were schematics of the circuitry, theory of operation, tutorials and guidance on usage, and even sample program segments showing the use of a board such as the disk drive controller.

Setting It Up

Unpacking the main carton, we found a neat, table-top enclosure containing a healthy power supply, a card cage with four slots, and three component boards plugged into the cage. In another box were four 8" diskettes and several manuals covering the UCSD p-System as used on the TM990/602 computer.

It should, however, be mentioned at this point that the TM990/522 table-top enclosure supplied to us is not the only one available. Like the TM990 boards, there is a selection of enclosures too. If you require more than four boards, order a larger enclosure. All of the card cages utilize the standard 100-pin TI-990 bus connectors.

We supplied our own display terminal for use with the 602 computer. It was a Televideo model 950, but almost any terminal will work.

Sorting through all the manuals, we found the TM990/602 Kit Configuration User's Guide. The first page contained a check list for installing the TM990/602 computer kit. There were only ten steps—the hardest ones were connecting the cables between the computer, disk drives, and terminal!

Here we were with a huge file of manuals and reference materials, but all we needed to get the computer working was that one page with the ten simple steps. These steps got us through the cable interconnections of the computers, dual eight inch disk drives, display terminal, and printer. The last two steps were:

*Insert the UCSD p-System disk in disk drive 1.

*Turn on the system power.

After about 40 seconds of blinking screen characters, multiple disk access, and various beeps from the terminal, the p-System greeting message appeared. All very simple.

Now that we have this TM990/602 computer, we plan to use it for testing p-System software for future reviews. The first review to come your way in the next PCM will be on TICOM's *Final Copy* software package [see the interview with Michael Hadjioannou, President of TICOM in this issue—Ed].

We are also planning to use the UCSD p-System to transfer files between the TM990/602 and a TI-99/4A system via the RS232 interface. Watch for this and much more in forthcoming issues.

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Pioneer . . . from p. 57

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*External routines

These features are fully backed up by the p-System with a minimum of hidden details and run-time "surprises."

A good set of coordinated system capabilities gives the developer the tools to build a solid and flexible software structure.

PCM—*We understand that you started your development work on a Texas Instruments TM990 board system. Could you tell us why you first chose it, and what advantages you found it to offer you...*

MH—Many advantages of the TM990 board system are common to the full line of TI computers. A good example is the use of the Texas Instruments TMS9900 microprocessor: The TMS9900 is a 16-bit microprocessor that uses a memory-to-memory architecture. This unique feature makes possible faster control transfer between modular software elements which compensates for much of the inherent slowness of the p-System.

A most important feature of the TM990 system is its flexibility. Not only do you have the flexibility of choosing which particular boards go into your computer, but each of the available boards have many selectable options.

During TICOM's internal software development, it was necessary to accomodate many different disk formats. The TM990 disk controller board allowed us the flexibility of using single-sided, double-sided, single or double density, and even 5 1/4" or 8" disk drives.

There are many other advantageous features such as a real-time clock, compact size, and use with any standard video terminal to name a few.

PCM—*In closing, what can you see for the future of the U.C.S.D. p-System in relation to software development and portability?*

MH—The p-System at this time offers a combination of some key factors better than any other alternative:

1. A high-level environment for the design, implementation and maintenance of modern turnkey applications.
2. True portability of applications across hardware environments.
3. A commitment by major hardware and software vendors to ensure its continued improvement and enhancement.

In 1978 we had glimpses of its potential. After four years of involvement, we are pleased to see much of that potential become reality.

Meanwhile, a new generation of hardware is appearing. Many technical and economic limitations are turning into memory. The software industry is again in transition with new, exciting possibilities. The challenge to be met now is for the p-System to keep growing in flexibility and capability—to continue supplying to the developer the proper mix of tools that will make possible an equally modern generation of software.

[Watch for the next issue of PCM in which TICOM's *Final Copy* software, an integrated word and data processing package, will be reviewed.—ED.]

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By
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Perhaps one of the toughest questions facing the educational community is how to use microcomputers in the elementary grades—that is, *if they are to be used at all*! TI LOGO is the obvious answer, except that, in some cases, the cost factor is seen as prohibitive. School districts have been hard hit by the economic crunch and consequently, there are a number of schools which only have TI-99/4As, with little or no software support. This is the situation in which we recently found ourselves.

We are two university professors, one in mathematics and one in education, who have been assisting local school districts in an effort to determine effective uses of microcomputers in their schools.

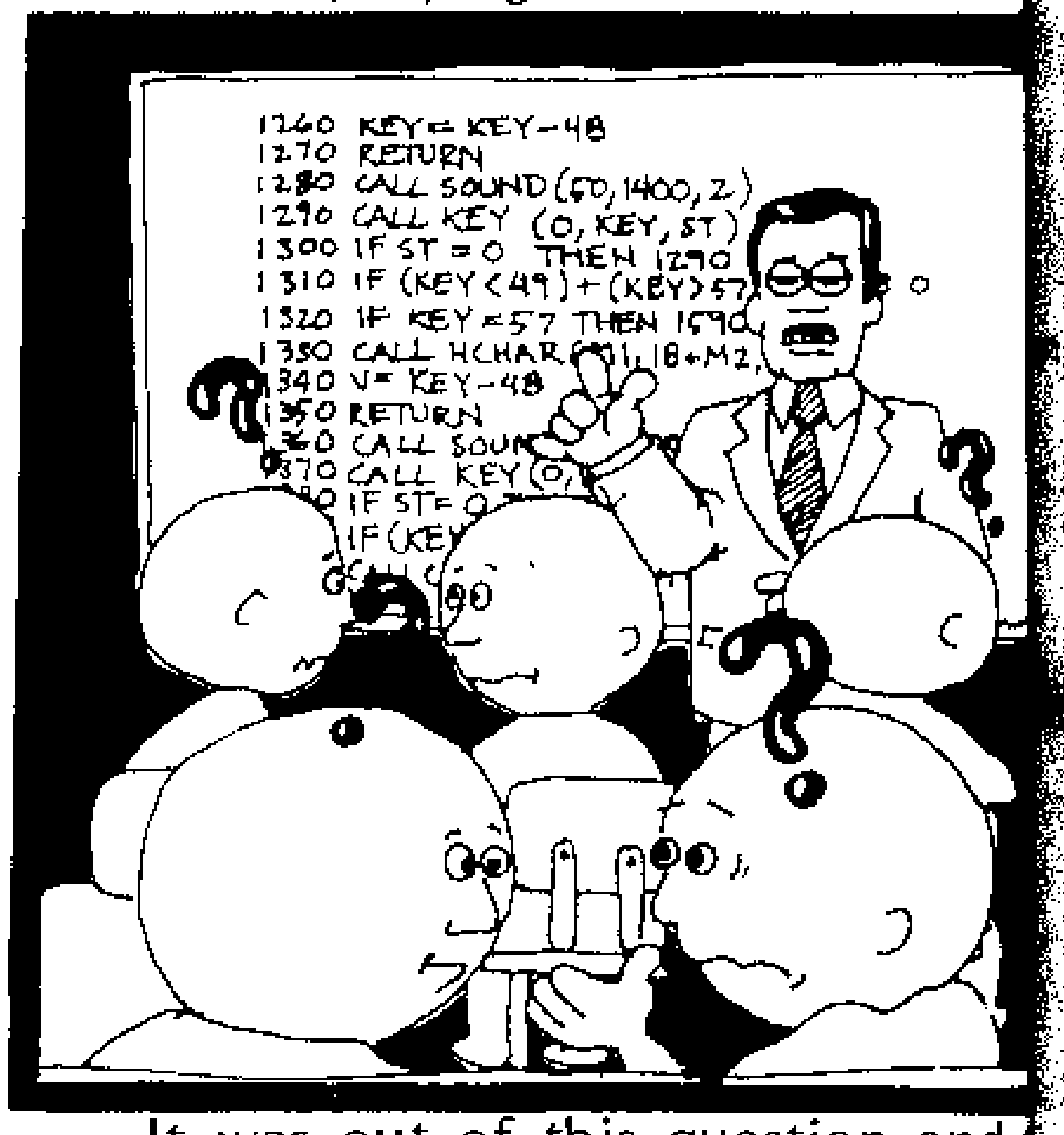
Because we have been working primarily with fourth and fifth graders, our initial response was to begin teaching the youngsters to program in BASIC. Although we did have some success, it became increasingly evident that there were more factors working *against* us than there were *for* us.

The children far outnumbered the available microcomputers, thereby allowing each child very little hands-on time. Sometimes as much as a week would pass before a child would have another opportunity to work at a micro. By then he would have forgotten or would be confused about, much of what he had learned previously. And the teachers, although enthusiastic and supportive, were ill-prepared to assist children with programming and technical difficulties.

Although these two real-world factors figured into our decision to abandon BASIC, they weren't as influential as the problems which the language itself presented for the children—especially in the color graphics area.

One capability of the TI-99/4A which children find fascinating is designing their own special graphics characters. Although the children are highly motivated by this capability, we have not found that they learn much from the experience. And the time needed to help the children make sense of hexadecimal code (required by some BASIC commands) seemed disproportionate to any benefits that might be gained. Mastering the use of ASCII codes and color-code-character groups also took considerable time. The meaning and order of the parameters in the graphics commands had to be explained over and over again.

Consequently, we frequently fo
ourselves saying to the children, "
copy the coding from the User's Re
ence Guide and don't worry ab
understanding it." After hearing
selves say this a number of times,
began to wonder what it was that
were really trying to teach children.



It was out of this question and
innumerable problems involving
arbitrariness of coding that AS
emerged. ASPIC stands for Amate
Special Purpose Instructional Code
is a language intended to facili
programming for children by elimina

ASPIC
(Amateur's Special Purpose Instructional Code)
– User Instructions –

I Program Statement Elements:
  A. *Variables, constants, expressions, shapes, relations*, and *quotes*.
    1. A *variable* can be any combination of letters or digits (except the space). The maximum length is 15 symbols. If only digits are used, the *variable* will be initially treated as an integer *constant*.
    2. *Constants* must be positive integers. To use negative integers or fractions, a *variable* must be set to the appropriate value using an *expression* and the LET statement.
    (e.g., if we want to use ½ or -1, the statements
    LET HALF = 1/2
    LET MINUS_ONE = 0 – 1
    can be used. Then HALF and MINUS_ONE will have the appropriate values).
    3. An *expression* takes the following form:
    var1 op var2 or *var1*
    where *var1* and *var2* are *variables* or *constants* and *op* is +, -, *, /, or ∧ (for exponentiation). Some examples of *expressions*:
    R 3 R+3 R*R 1/2
    An *expression* will be evaluated using the current values of the *variables.*
    4. A *relation* takes the following form:
    exp1 relsym exp2
    where *exp1* and *exp2* are *expressions* and *relsym* is one of the followi
    < > <> = <= >=
    Examples of *relations*:
    R < 24
    R + 1 <> J + 2
    ROW = COL*C
    The *expressions* will be evaluated and the *relations* will then be true
    false.
    5. A *shape* can be any combination of 15 or fewer symbols. Since *sha*
    and *variables* are used in different contexts, the same string of symb
    can be used as a *shape* and a *variable*.
    6. A *quote* is a string of at most 60 symbols which, on command, can
    printed out.
  B. Predefined Symbols.
    1. There is a predefined *variable* LOOK, used in conjunction with
    LOOK command.
    2. There are 3 predefined *shapes*:
    BL which is blank
    BOX which is a solid box
    (These can be redefined using the MAKE command.)
    SCREEN is not really a *shape*—it is used with the COLOR command
    change the color of the background. You cannot define a *shape* SCRE
    to use with MAKE or DRAW.
  C. Colors: The available colors are:
  CLEAR, BLACK, GREEN, BLUE, RED, ORANGE, YELLOW, PU
  PLE, and GRAY

the more technical dimensions of BASIC, and by utilizing a logic more consistent with a child's way of thinking.

The remainder of this article will describe some of the programs that we have written with the children, and the kind of learning that we feel has ensued.

Initially, the children are taught how to use the MAKE command to design shapes and then how to position their shapes at specific places on the screen. When the MAKE command is executed, the screen is cleared and an 8 x 8 grid appears in the center. By alternating the symbols 1 and 0, the child can choose to blacken in one of the sixty-four grid boxes or not. What they draw is an enlarged version of the shape specified. They have commands available to assign the colors they want, for both the shape and the screen background.

The DRAW command allows the children to identify the row and the column in which they wish to place the shape. After the children understand these commands, they can be taught how to place any number of shapes vertically, horizontally, and diagonally on the screen. And once they have acquired these programming skills, we assign problems to solve like the following:

"MAKE" IT "CLEAR" WITH ASPIC!

"It is a language intended to facilitate programming for children by eliminating the more technical dimensions of BASIC and by utilizing a logic more consistent with a child's way of thinking."

> Start one shape in row #5, column #5; start a second shape in row #21, column #13; collide the two shapes in row #5, column #13.

The children then write programs to solve the problem. One such ASPIC program is given below:

```
 10 CLEAR
 20 MAKE +
 30 MAKE X
 40 COLOR SCREEN RED
 50 COLOR + BLACK
 60 COLOR X GRAY
 70 LET R1 = 5
 80 LET C1 = 5
 90 LET R2 = 21
100 LET C2 = 13
110 REPEAT 9
120 DRAW + IN ROW#R1
    COL#C1
130 DRAW X IN ROW#R2
    COL#C2
140 LET C1 = C1 + 1
150 LET R2 = R2 - 2
160 END
```

[For a complete description of all the ASPIC commands shown in the sample programs, see the "User's Instructions" portion of this article—Ed.]

Since the children must put in explicit commands to change the values of the variables (unlike with the "FOR" loop in BASIC), this kind of program has proven especially valuable in helping the children understand the difference between a constant and a variable. It has also introduced them to a simple coordinate system and shown them how to locate a position within that system.

The process involved in colliding shapes has taught the children to consider relative positions. They then quickly advance from simple problems to more complex problems involving collisions along diagonals, and collisions of three or more shapes. Although, we do not refer directly to the "slope of a line," the children cannot complete the programs without an implicit understanding of the meaning of that concept.

A problem similar to the above, asks the children to draw a square on the screen and then to prove it a square. One solution entails the use of a diagonal. The ASPIC program follows:

```
10 CLEAR
20 COLOR SCREEN BLACK
30 COLOR BOX RED
40 DRAW (16 ACROSS) BOX IN
     ROW#5 COL#5
```

D. Program Statement Line Numbers
Each statement must be given a line number between 1 and 16383. The program is listed in order of line numbers (See section III, Using ASPIC, for more details).

II Program statement definitions:

A. In the description of the statements that follow, we will use these abbreviations:
var, var_1, var_2 etc. for *variables*
exp, exp_1, exp_2 etc. for *expressions*
rel for *relation*

1. ASK FOR *var*
This is an input statement; when it is executed, "?" will appear. A number is to be typed in (it can be negative or a decimal). The *variable* *var* will then be assigned that value.
Example: ASK FOR COL
2. CLEAR
When executed, the screen will clear.
3. COLOR *shape* color
When executed, the *shape* will be colored the specified color. All copies of that *shape* on the screen will be changed to the specified color and all copies drawn afterwards will be that color.
Examples: COLOR TRUCK RED
COLOR BOX BLUE
4. COLOR SCREEN color
When executed, the background will change to the specified color.
Example: COLOR SCREEN GREEN
5. DRAW *shape* IN ROW# exp_1 COL# exp_2
When executed exp_1 and exp_2 will be evaluated, and the *shape* will be drawn in the appropriate row and column. The row must be between 1 and 24, the column between 1 and 32.
Note: The row and column can be specified in either order.
See examples below:
DRAW BOX IN ROW#1 COL#C
DRAW BL IN COL# C+1 ROW#R
6. DRAW (exp_3 ACROSS) *shape* in ROW# exp_1 COL# exp_2
Like DRAW, except exp_3 will also be evaluated and that many copies of *shape* will be drawn horizontally.
Examples: DRAW (32 ACROSS) BL IN ROW#R COL#1
DRAW (768 ACROSS) BOX IN COL#1 ROW#1
7. DRAW(exp_3 DOWN) *shape* in ROW# exp_1 COL# exp_2
Like DRAW ACROSS except the copies will be drawn vertically.
Example: DRAW (4DOWN) LINE IN ROW#R–5 COL#C
8. ELSE
Used with IF . . . THEN and END. Control passes to statement following ELSE when *relation* in IF . . . THEN is false.
9. END
Used in conjunction with IF . . . THEN, ELSE, REPEAT, and REPEAT WHILE. Marks the end of the program section. See those other commands for more details.
10. IF *rel* THEN
This is paired with an END statement. The *expression* is evaluated. If it is true, control passes to the following statement. Execution con-

```
 50 DRAW (16 DOWN) BOX IN
    ROW#5 COL#5
 60 DRAW (16 ACROSS) BOX IN
    ROW#20 COL#5
 70 DRAW (16 DOWN) BOX IN
    ROW#5 COL#20
 80 LET R = 5
 90 LET C = 5
100 REPEAT 16
110 DRAW BOX IN ROW#R
    COL#C
120 LET R = R + 1
130 LET C = C + 1
140 END
```

There are, of course, other possible solutions to the above problem, such as the following program:

```
 10 MAKE GRAYBOX
 20 CLEAR
 30 COLOR SCREEN BLACK
 40 COLOR BOX RED
 50 DRAW (16 ACROSS) BOX IN
    ROW#5 COL#5
 60 DRAW (16 DOWN) BOX IN
    ROW#5 COL#5
 70 DRAW (16 ACROSS) BOX IN
    ROW#20 COL#5
 80 DRAW (16 DOWN) BOX IN
    ROW#5 COL#20
 90 COLOR GRAYBOX GRAY
100 LET RC = 5
110 REPEAT 16
120 DRAW GRAYBOX IN ROW#5
    COL#RC
130 DRAW GRAYBOX IN
    ROW#RC COL#5
140 LET RC = RC + 1
150 END
```

Children particularly seem to enjoy problems with multiple solutions. These encourage them to "swap" answers and to assess relative values. Considerable peer group tutoring occurs when children exchange their insights into problems. The clarity of ASPIC gives greater assurance that these exchanges will be profitable.

After working with graphics, we introduced the children to programs that solved word problems, using multiplication and division. The intention here was to deepen the children's understanding of these arithmetic operations and, consequently, to help them distinguish when to use each. In the following problem, the children had to write a program which demonstrated the meaning of one mode of division:

> You have $5.00 with which you want to purchase as many water guns as possible. If each water gun costs $0.69, how many can you buy?

```
10 CLEAR
20 LET MONEY = 500
30 PRINT MONEY
40 PRINT " "
50 LET COST = 69
60 REPEAT UNTIL MONEY <
   COST
70 LET MONEY = MONEY
   − COST
80 PRINT MONEY
90 END
```

The children realize that a gun is purchased each time the money decreases by 69 cents. They count the number of successive subtractions to find the number of guns. Once the children are clear on the meanings of the operations, they can be encouraged to shorten the programs to represent the algorithms for multiplication and division.

The third type of problem that we have used extensively with children is concerned with the construction of sequences. The following is typical:

> You have blocks of wood that are one inch thick. Starting with a single block of wood, you double the number of blocks each time you make another stack. How many doublings will it take before one of the stacks goes over one mile high?

```
10 CLEAR
20 LET INCHES = 1
30 PRINT INCHES
40 REPEAT UNTIL INCHES >
   63360
50 LET INCHES = INCHES * 2
60 PRINT INCHES
70 END
```

As the program prints each doubling on the screen, the children keep count. They are always amazed at how quickly the numbers increase in value and are inclined to find larger and larger numbers. Eventually, the children's enthusiasm for large numbers results in the values being displayed in scientific notation. They invariably asked us to explain the "strange stuff on the screen" and had little difficulty comprehending an explanation.

Another problem of this kind that children find challenging is solving a sequence for the n^{th} number. For example, find the 18th number in the Fibonnacci sequence: 1,1,2,3,5,8 . . .

```
 10 CLEAR
 20 LET FIRST = 1
 30 PRINT FIRST
 40 LET SECOND = 1
 50 PRINT SECOND
 60 REPEAT 16
 70 LET NEXT = FIRST +
    SECOND
 80 PRINT NEXT
 90 LET FIRST = SECOND
100 LET SECOND = NEXT
110 END
```

The children need to solve simpler problems before attempting one this difficult. However, with practice, they become quite adept at identifying sophisticated relationships within a group of numbers. They can then proceed to develop sequences of their own and can challenge each other to write programs solving them.

ASPIC offers innumerable programming possibilities to children who are not yet ready for the complexity of BASIC. Only a few have been enumer-

tinues normally unless an ELSE statement is encountered. Then, control passes to the statement following the END statement. If no ELSE statement is encountered, execution proceeds normally.
If the *expression* is false, an ELSE statement is searched for. If one is found before the END, control passes to that ELSE statement. If none is found, control passes to the statement following END.

EXAMPLES OF PROGRAM FRAGMENTS:

```
10  IF ROW <=24 THEN
20  DRAW TRUCK IN ROW# ROW COL#C
30  DRAW BL IN ROW# ROW COL#C
40  LET ROW = ROW +1
50  ELSE
60  LET C=C+1
70  LET ROW =L
80  END

100 IF ROW = COL THEN
200 DRAW BOX IN COL# COL ROW# ROW
300 END
```

11. LET *var = exp*
When executed, *exp* is evaluated and that value is assigned to *var*.

```
Examples: LET ROW = ROW +1
          LET COL = 1
          LET LOOK =0
```

12. LOOK
When executed, a check is made to see if a key on the keyboard is being pressed. If one is, the *variable* LOOK is given a value of -1. If not the *variable* LOOK is given a value of 0.

13. MAKE *shape*
When executed, the screen is cleared and an 8x8 white grid appears in the center. Press 1 to blacken in a box, 0 to not blacken in a box. A rectangle indicates the location of box. To correct, backspace and re-type. If all the boxes you want have been filled in, use enter. The *shape* specified will be a miniature version of what you have drawn.

14. PRINT *exp*
The *expression* will be evaluated and its value printed.

15. PRINT "*quote*"
The *quote* will be printed.

16. REPEAT *exp*
This is paired with an END statement. The *expression* will be evaluated, and the section of the program between REPEAT and END will be repeated that many times. Note, the *expression* is not re-evaluated after the repetitions, so changes in the *variables* used in the *expression* have no effect on the number of repetitions.

EXAMPLES OF A PROGRAM FRAGMENT:

```
5   ASK FOR I
10  REPEAT I
20   PRINT I
30  LET I = I + 1
40  END
90  LET ROW = 1
```

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ated here. Examination of the ASPIC language listing and the accompanying user instructions will reveal a number of commands that have not been used in the sample programs presented here. The next article in this series will explore some of these commands.

Acknowledgements

ASPIC was used extensively with students in the PAT program at Timberline Elementary School in the Grapevine/Colleyville Independent School District. Special thanks is directed to Mrs. Wanda Kirkpatrick, teacher, and Mr. Charles Dunn, principal.

Technical Information

ASPIC is an interpreted language. As an ASPIC program is written, the syntax of each statement is analyzed when the statement is entered. If the statement is valid, it is encoded and put in its proper place, according to its line number. If it is invalid, an error message is given. The symbol table and storage locations are created as the program is entered. At run-time, an encoded statement is interpreted into BASIC and executed. Run-time diagnostics are limited, but if a program is aborted due to a run-time error (such as an invalid row number in a DRAW command), the computer returns to ASPIC rather than BASIC. The ASPIC interpreter itself is a BASIC program. [See our leadoff article in this issue—Ed.]

EXPLANATION OF THE PROGRAM
ASPIC

Line Nos.	
160-570	Initialization.
580-630	"NEW" routine.
640-910	Read instruction.
920-2030	Encode program statement.
2040-2150	Remove line number from program.
2160-2370	Add line to program.
2380-3070	"LIST" routine.
3080-3350	"OLD" routine.
3360-3630	"SAVE" routine.
3640-5270	"RUN" routine.
5280-5710	Subroutines used in encoding statements.
5720-5760	Error messages.
5770-5890	Run-time evaluation of arithmetic expression.
5900-6040	Run-time evaluation of Boolean expression.
6050-6160	Find appropriate "END".
6170-6200	Skip to "END".
6210-6260	Find first word in statement.
6270-6320	Find line number in program.
6330-6380	Add shape name to list.
6390-6450	Add variable name to list.
6460-6530	Check for integer constant.

ASPIC listing starts on p. 68

```
100  REPEAT 24
110  DRAW TRUCK IN ROW# ROW COL#ROW
120  LET ROW = ROW +1
130  END
```

17. REPEAT UNTIL *rel*

This is paired with an END statement. The *relation* is evaluated. If it is true, the section of the program between REPEAT UNTIL and END is executed. The REPEAT UNTIL statement is then re-executed. Thus the program chunk is repeated UNTIL the expression evaluates FALSE. Then control passes to the statement after END.

EXAMPLE OF A PROGRAM FRAGMENT:

```
90   LET ROW = 1
100  ASK FOR K
110  REPEAT UNTIL ROW >24
120  DRAW (K DOWN) BOX IN ROW# ROW COL#10
130  LET ROW = ROW +K
140  END
```

18. SOUND

When executed, makes a "white" noise.

19. STOP

Halts program execution.

Note about control structures:

IF . . . THEN . . . ELSE, REPEAT and REPEAT UNTIL can be nested. Each must have its own END statement.

EXAMPLES:

```
10   CLEAR
20   MAKE TRUCK
30   LET C=1
40   REPEAT 32
50   LET R=1
60   REPEAT UNTIL R > 24
70   IF R <> 5 THEN
80   DRAW TRUCK IN ROW#R COL#C
90   END
100  LET R=R+1
110  END
120  LET C=C+1
130  END
```

III Using ASPIC

After loading the ASPIC interpreter and typing RUN, a "?" will appear. You are now in ASPIC. To enter a program—type a line number, space and command for each program line. The lines can be typed in any order. To change a line, before ENTER is pressed, you may backspace and use the editing functions of the TI-99/4(A). After a line has been ENTERED, to change it, retype it with the same line number. Typing the line number, with nothing after it, deletes the line.

To RUN a program, type RUN.
To LIST a program, type LIST.
To save a program on tape, type SAVE.
To get a program off the tape, type OLD.
To erase one program and start fresh, type NEW.
While a program is running, typing "?", will cause the program to halt.

THE "PROWRITER" IS HERE!!!

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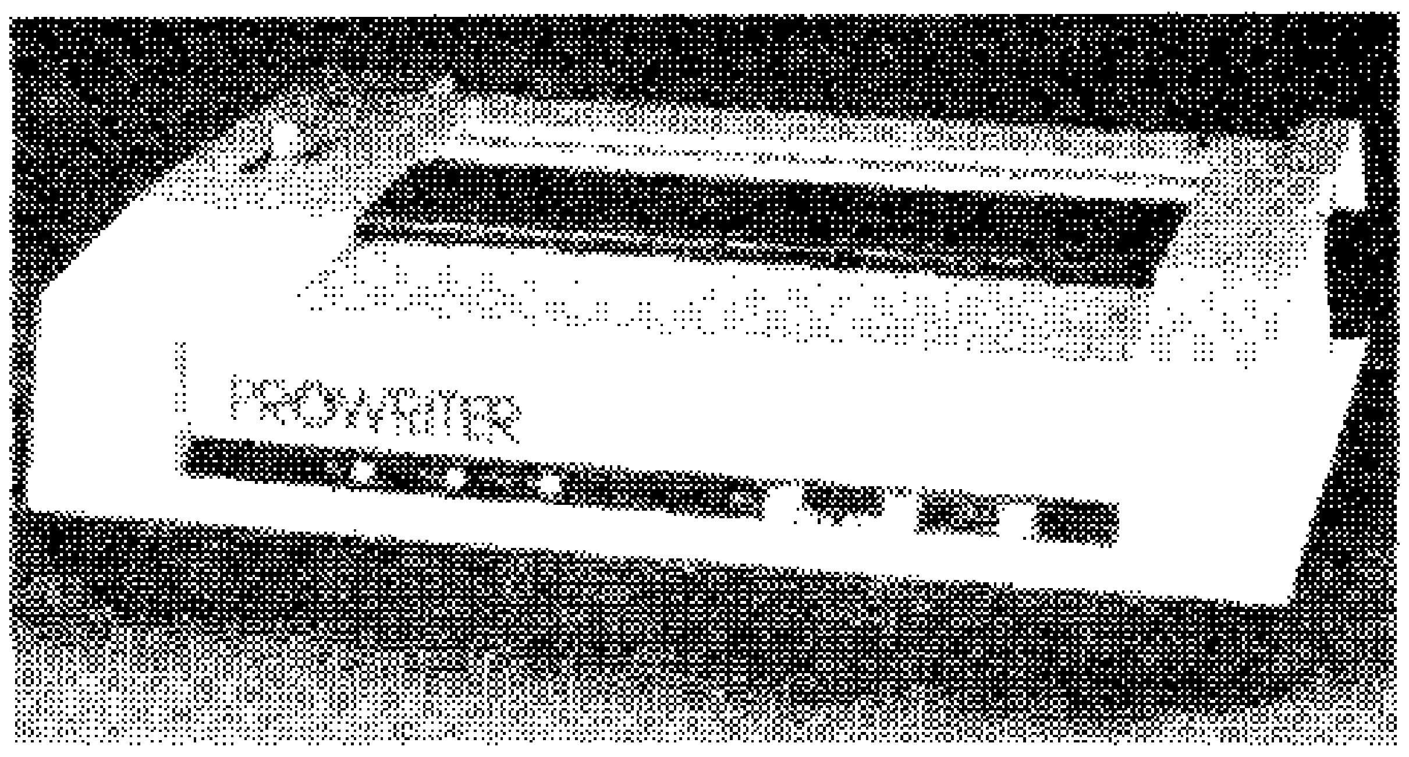

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ASPIC . . . from p. 67

```
100 REM  ***********
110 REM  *  ASPIC  *
120 REM  ***********
130 REM  BY DR. ANDREW BERNER
135 REM
140 REM  99'ER VERSION 2.1
    .1
150 REM
160 CALL SCREEN(8)
170 CALL CLEAR
180 DIM P$(54,6)
190 DIM S$(9,0)
200 DIM L$(45)
210 DIM L(45)
220 DIM C$(18)
230 DIM CO$(16)
240 DEF N(X$)=128*ASC(X$)+
    ASC(SEG$(X$,2,1))
250 DEF N$(X)=CHR$(INT(X/1
    28))&CHR$(X-128*INT(X/
    128))
260 DEF A(X)=ASC(P$(CI,X))
270 DEF B$=SEG$(A$,S+1,LEN
    (A$))
280 DATA IF,REPEAT,REPEAT,
    END,ELSE,LET,COLOR,DRA
    W,DRAW,DRAW,MAKE,LOOK,
    SOUND,PRINT,PRINT,ASK,
    CLEAR,STOP
290 FOR I=1 TO 18
300 READ C$(I)
310 NEXT I
320 DATA <=,>=,<>,=,<,>
330 FOR I=1 TO 6
340 READ R$(I)
350 NEXT I
360 DATA +,-,*,/,^
370 FOR I=1 TO 5
380 READ O$(I)
390 NEXT I
400 DATA RUN,LIST,OLD,NEW,
    SAVE
410 FOR I=1 TO 5
420 READ K$(I)
430 NEXT I
440 DATA BREAK,DONE,BAD VA
    LUE,,MEMORY FULL,END M
    ISSING,WRONG STATEMENT
450 FOR I=0 TO 6
460 READ E$(I)
470 NEXT I
480 DATA CLEAR,BLACK,,GREE
    N,,BLUE,,,RED,,ORANGE,
    YELLOW,,PURPLE,GRAY,WH
    ITE
490 FOR I=1 TO 16
500 READ CO$(I)
510 NEXT I
520 L$(0)=CHR$(0)
530 L$(1)=C$(12)
540 S$(0,0)="SCREEN"
550 S$(1,0)="BL"
560 CALL CHAR(96,"FFFFFFFF
    FFFFFFFF")
570 S$(2,0)="BOX"
580 P$(0,0)=CHR$(0)
590 P$(0,1)=CHR$(1)
600 P$(0,2)=CHR$(0)
610 P$(0,3)=CHR$(1)
620 P$(0,4)=CHR$(0)
630 P$(0,5)=CHR$(2)
640 INPUT A$
650 W$=A$
660 GOSUB 6210
670 GOSUB 6460
680 IF NC>0 THEN 780
690 FOR I=1 TO 5
700 IF W$=K$(I)THEN 770
710 NEXT I
720 I=6
730 CALL SOUND(100,440,0)
740 PRINT :E$(I)
750 CALL SCREEN(8)
760 GOTO 640
770 ON I GOTO 3640,2380,30
    80,580,3360
780 FOR I=0 TO 4
790 T$(I)=""
800 NEXT I
810 J$=N$(NC)
820 A$=B$
830 IF A$="" THEN 2050
```

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```
840 W$=A$
850 GOSUB 6210
860 FOR I=1 TO 18
870 IF W$=C$(I)THEN 890
880 NEXT I
890 T$(0)=CHR$(I)
900 A$=B$
910 ON I GOTO 920,980,1060
    ,1090,1090,1110,1230,1
    360,1360,1360,1710,109
    0,1090,1770,1770,1950,
    1090,1090,720
920 IF POS(A$,"THEN",LEN(A
    $)-3)=0 THEN 720
930 A$=SEG$(A$,1,LEN(A$)-4
    )
940 GOSUB 5450
950 IF LEN(I$)=0 THEN 720
960 T$(1)=I$
970 GOTO 2160
980 W$=A$
990 GOSUB 6210
1000 IF W$="UNTIL" THEN 10
     60
1010 X$=A$
1020 GOSUB 5280
1030 IF LEN(X$)=0 THEN 720
1040 T$(1)=X$
1050 GOTO 2160
1060 T$(0)=CHR$(3)
1070 A$=SEG$(A$,S+1,LEN(A$
     )-S)
1080 GOTO 940
1090 IF LEN(A$)>0 THEN 720
1100 GOTO 2160
1110 K=POS(A$,"=",1)
1120 IF K=0 THEN 720
1130 W$=SEG$(A$,1,K-1)
1140 GOSUB 6210
1150 IF LEN(W$)=0 THEN 720
1160 GOSUB 6390
1170 T$(1)=CHR$(I)
1180 X$=SEG$(A$,K+1,LEN(A$
     ))
1190 GOSUB 5280
1200 IF LEN(X$)=0 THEN 720
1210 T$(2)=X$
1220 GOTO 2160
1230 W$=A$
1240 GOSUB 6210
1250 IF W$="" THEN 720
1260 GOSUB 6330
1270 T$(1)=CHR$(I)
1280 W$=B$
1290 GOSUB 6210
1300 FOR I=1 TO 15
1310 IF W$=CO$(I)THEN 1340
1320 NEXT I
1330 GOTO 720
1340 T$(2)=CHR$(I)
1350 GOTO 2160
1360 K=POS(A$,"(",1)
1370 IF K>0 THEN 1570
1380 H=1
1390 W$=A$
1400 GOSUB 6210
1410 IF W$="" THEN 720
1420 GOSUB 6330
1430 T$(H)=CHR$(I)
1440 A$=B$&"END#"
1450 DATA ROW#,COL#
1460 RESTORE 1450
1470 FOR H=H+1 TO H+2
1480 READ W$
1490 K=POS(A$,W$,1)
1500 IF K=0 THEN 720
1510 X$=SEG$(A$,K+4,POS(A$
     ,"#",K+4)-7-K)
1520 GOSUB 5280
1530 IF LEN(X$)=0 THEN 720
1540 T$(H)=X$
1550 NEXT H
1560 GOTO 2160
1570 S=POS(A$,"DOWN)",1)
1580 IF S=0 THEN 1610
1590 T$(0)=CHR$(10)
1600 GOTO 1640
1610 S=POS(A$,"ACROSS)",1)
1620 IF S=0 THEN 720
1630 T$(0)=CHR$(9)
1640 X$=SEG$(A$,K+1,S-K-1)
1650 A$=SEG$(A$,POS(A$,")"
     ,S)+1,LEN(A$))
```

Continued on p. 70

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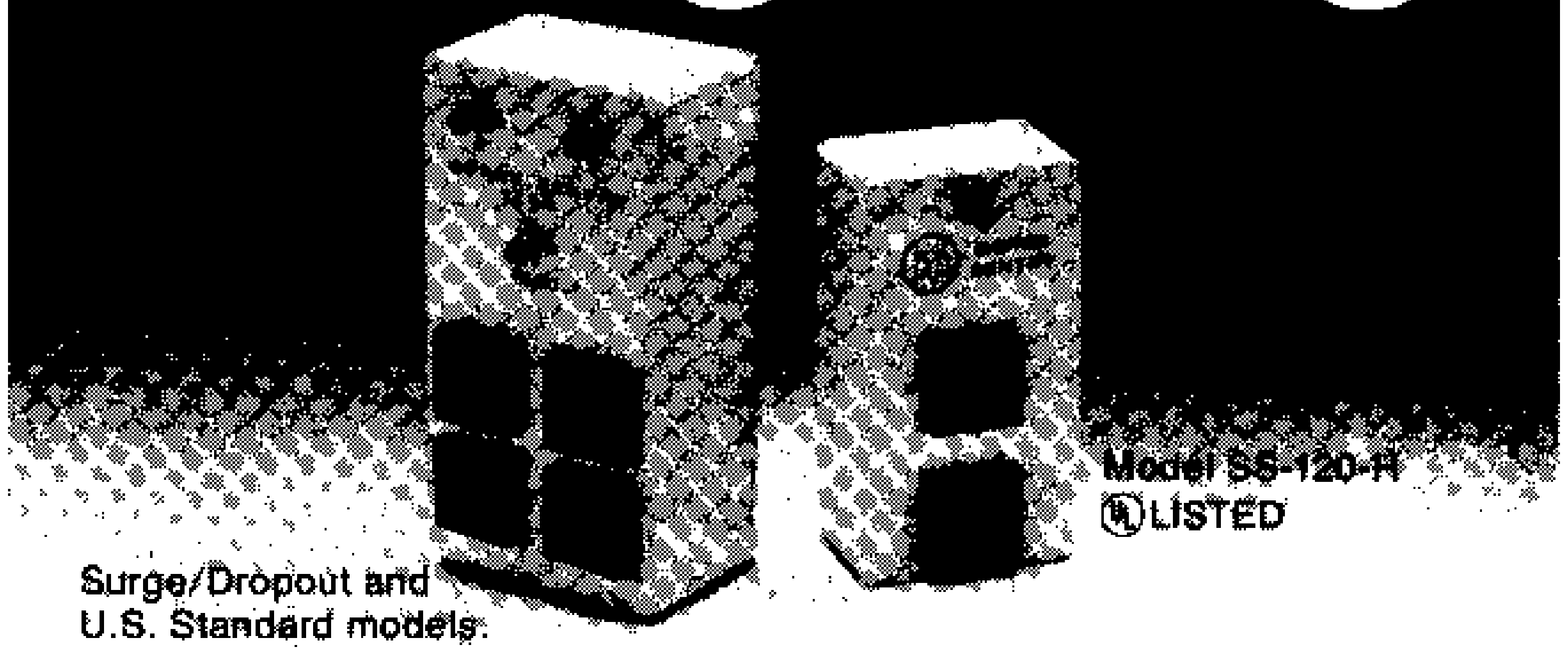

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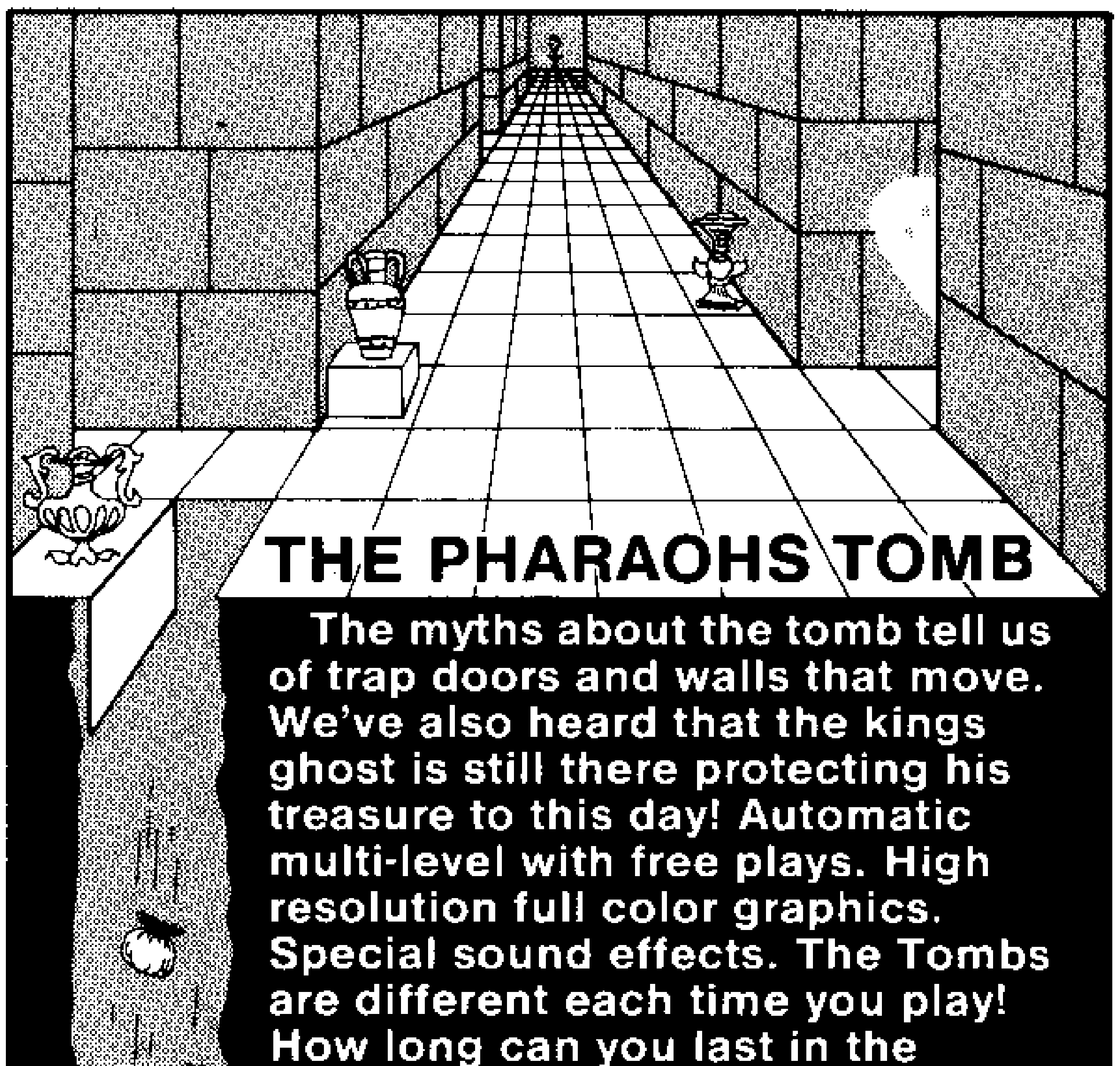

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ASPIC . . . from p. 69

```
1660 GOSUB 5280
1670 IF X$="" THEN 720
1680 T$(1)=X$
1690 H=2
1700 GOTO 1390
1710 W$=A$
1720 GOSUB 6210
1730 IF W$="" THEN 720
1740 GOSUB 6330
1750 T$(1)=CHR$(I)
1760 GOTO 2160
1770 S=POS(A$,CHR$(34),1)
1780 IF S>0 THEN 1850
1790 X$=A$
1800 GOSUB 5280
1810 IF LEN(X$)=0 THEN 720
1820 T$(1)=X$
1830 T$(0)=CHR$(15)
1840 GOTO 2160
1850 K=POS(A$,CHR$(34),S+1
     )
1860 IF K=0 THEN 720
1870 W$=SEG$(A$,S+1,K-S-1)
1880 FOR I=0 TO ASC(P$(0,4
     ))
1890 IF W$=Q$(I)THEN 1930
1900 NEXT I
1910 Q$(I)=W$
1920 P$(0,4)=CHR$(I)
1930 T$(1)=CHR$(I)
1940 GOTO 2160
1950 W$=A$
1960 GOSUB 6210
1970 IF W$<>"FOR" THEN 720
1980 W$=B$
1990 GOSUB 6210
2000 IF W$="" THEN 720
2010 GOSUB 6390
2020 T$(1)=CHR$(I)
2030 GOTO 2160
2040 IF P$(I,1)=N$(NC)THEN
      2310
2050 GOSUB 6270
2060 IF A(0)=0 THEN 2150
2070 IF P$(A(0),1)<>J$ THE
     N 2150
2080 I=A(0)
2090 P$(CI,0)=P$(I,0)
2100 P$(I,0)=P$(0,2)
2110 P$(0,2)=CHR$(I)
2120 FOR K=1 TO 6
2130 P$(I,K)=""
2140 NEXT K
2150 GOTO 640
2160 GOSUB 6270
2170 I=A(0)
2180 IF I=0 THEN 2200
2190 IF P$(I,1)=J$ THEN 23
     10
2200 I=ASC(P$(0,2))
2210 IF I=0 THEN 2260
2220 P$(0,2)=P$(I,0)
2230 P$(I,0)=P$(CI,0)
2240 P$(CI,0)=CHR$(I)
2250 GOTO 2310
2260 I=ASC(P$(0,1))
2270 IF I=55 THEN 2360
2280 P$(0,1)=CHR$(I+1)
2290 P$(I,0)=P$(CI,0)
2300 P$(CI,0)=CHR$(I)
2310 P$(I,1)=J$
2320 FOR K=0 TO 4
2330 P$(I,K+2)=T$(K)
2340 NEXT K
2350 GOTO 640
2360 I=4
2370 GOTO 730
2380 CI=0
2390 CI=A(0)
2400 IF CI=0 THEN 640
2410 I=3
2420 A$=C$(A(2))&" "
2430 ON A(2)GOSUB 2750,278
     0,2810,2520,2520,2840
     ,2870,2930,2900,2960,
     2980,2520,3010,3030,2
     780,3060,2520,2520
2440 GOTO 2390
2450 READ W$
2460 IF W$="" THEN 2520
2470 IF ASC(W$)>39 THEN 25
     00
```

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```
2480 ON ASC(W$)-34 GOSUB 2
     580,2610,2680,2700,27
     20
2490 I=I+1
2500 A$=A$&W$&" "
2510 GOTO 2450
2520 PRINT STR$(N(P$(CI,1)
     ))&" "&A$
2530 RETURN
2540 W$=L$(ASC(SEG$(X$,3,1
     )))
2550 IF SEG$(X$,1,2)=(CHR$
     (1)&CHR$(0))THEN 2570
2560 W$=L$(ASC(SEG$(X$,2,1
     )))&D$(ASC(X$))&W$
2570 RETURN
2580 X$=P$(CI,I)
2590 GOSUB 2540
2600 RETURN
2610 X$=SEG$(P$(CI,I),2,3)
2620 GOSUB 2540
2630 I$=W$&R$(A(I))
2640 X$=SEG$(P$(CI,I),5,3)
2650 GOSUB 2540
2660 W$=I$&W$
2670 RETURN
2680 W$=L$(A(I))
2690 RETURN
2700 W$=CO$(A(I))
2710 RETURN
2720 W$=S$(A(I),0)
2730 RETURN
2740 DATA $,THEN,
2750 RESTORE 2740
2760 GOTO 2450
2770 DATA #,
2780 RESTORE 2770
2790 GOTO 2450
2800 DATA UNTIL,$,
2810 RESTORE 2800
2820 GOTO 2450
2830 DATA %,=,#,
2840 RESTORE 2830
2850 GOTO 2450
2860 DATA ',&,
2870 RESTORE 2860
2880 GOTO 2450
2890 DATA (,#,ACROSS)
2900 RESTORE 2890
2910 GOTO 2450
2920 DATA ',IN ROW#,#,COL#
     ,#,
2930 RESTORE 2920
2940 GOTO 2450
2950 DATA (,#,DOWN),',IN R
     OW#,#,COL#,#,
2960 RESTORE 2950
2970 GOTO 2450
2980 A$=A$&S$(A(3),0)
2990 GOTO 2520
3000 DATA ,
3010 RESTORE 3000
3020 GOTO 2450
3030 A$=A$&CHR$(34)&Q$(A(3
     ))&CHR$(34)
3040 GOTO 2520
3050 DATA FOR,%,
3060 RESTORE 3050
3070 GOTO 2450
3080 OPEN #1:"CS1",INTERNA
     L,INPUT ,FIXED 192
3090 CI=0
3100 FOR I=0 TO 6
3110 INPUT #1:P$(0,I),
3120 NEXT I
3130 FOR I=3 TO 9
3140 INPUT #1:S$(I,0),
3150 NEXT I
3160 INPUT #1:A$
3170 FOR I=1 TO A(1)STEP 9
3180 FOR H=0 TO 8
3190 FOR K=0 TO 6
3200 INPUT #1:P$(I+H,K),
3210 NEXT K
3220 NEXT H
3230 INPUT #1:A$
3240 NEXT I
3250 FOR I=2 TO A(3)STEP 1
     1
3260 FOR K=0 TO 10
3270 INPUT #1:L$(I+K),
3280 NEXT K
3290 INPUT #1:A$
3300 NEXT I
3310 FOR I=1 TO A(4)STEP 3
3320 INPUT #1:Q$(I),Q$(I+1
     ),Q$(I+2)
3330 NEXT I
3340 CLOSE #1
3350 GOTO 640
3360 OPEN #1:"CS1",INTERNA
     L,OUTPUT,FIXED 192
3370 CI=0
3380 FOR I=0 TO 6
3390 PRINT #1:P$(0,I);
3400 NEXT I
3410 FOR I=3 TO 9
3420 PRINT #1:S$(I,0);
3430 NEXT I
3440 PRINT #1:""
3450 FOR I=1 TO A(1)STEP 9
3460 FOR H=0 TO 8
3470 FOR K=0 TO 6
3480 PRINT #1:P$(I+H,K);
3490 NEXT K
3500 NEXT H
3510 PRINT #1:""
3520 NEXT I
3530 FOR I=2 TO A(3)STEP 1
     1
3540 FOR K=0 TO 10
3550 PRINT #1:L$(I+K);
3560 NEXT K
3570 PRINT #1:""
3580 NEXT I
3590 FOR I=1 TO A(4)STEP 3
3600 PRINT #1:Q$(I);Q$(I+1
     );Q$(I+2)
3610 NEXT I
3620 CLOSE #1
3630 GOTO 640
3640 FOR I=1 TO ASC(P$(0,3
     ))
3650 W$=L$(I)
3660 GOSUB 6460
3670 L(I)=0
3680 IF NC=-1 THEN 3700
3690 L(I)=NC
3700 NEXT I
3710 T=46
3720 CI=0
```

Continued on p. 73

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Dynamic Data and Devices is now offering the new Direct Writer word processing software written by Curt Garcia and Harold Patrick for the TI Extended BASIC language. Direct Writer uses specially designed assembly language subroutines to provide the Home Computer user with big computer performance.

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Automatic centering, right justification, and string search/replace are other standard features.

Direct Writer can print over 200 pages of text, and stored files may be linked together to print a complete manuscript in one continuous print operation.

Direct writer requires a TI-99/4(A) Home Computer, TI Extended BASIC cartridge, TI Expansion Memory, TI Disk Controller, at least one disk Drive, and either the TI Thermal printer or TI RS232 Interface with a compatible printer.

It is available on diskette and comes with a 36-page manual of instructions and examples. For more information contact Dynamic Data and Devices, P. O. Box 912, Stafford, Texas 77477.

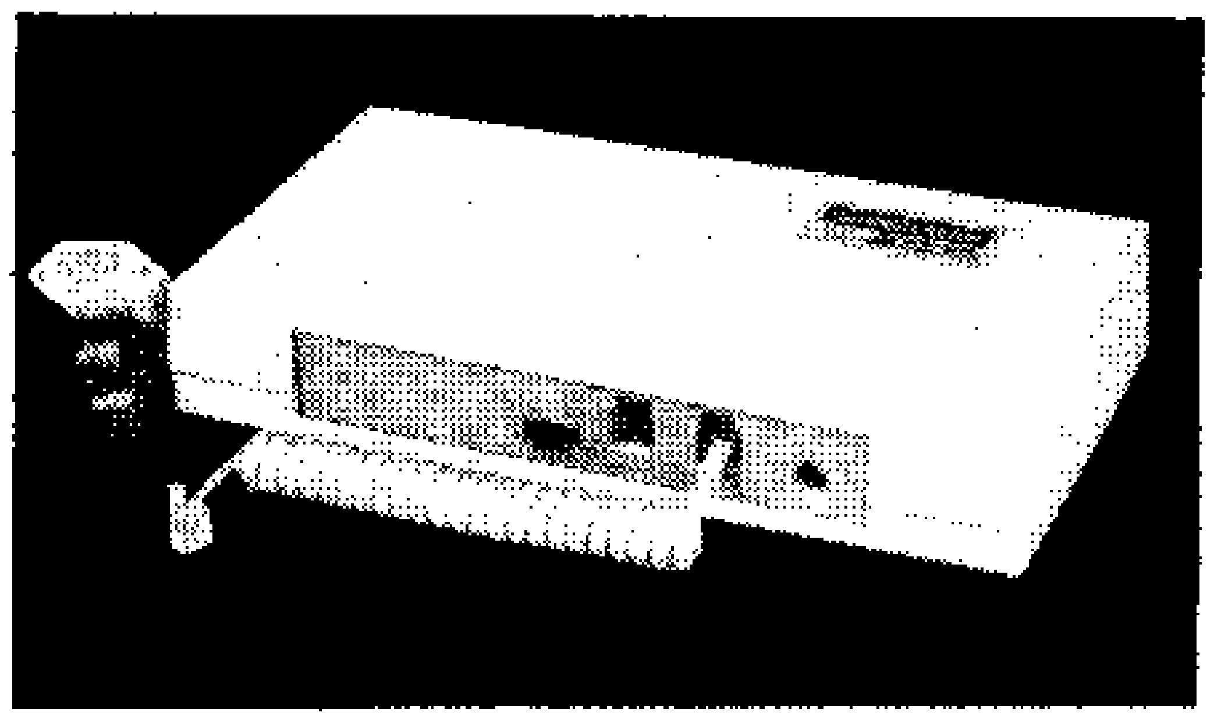
VIDEO GAME CONTEST

PS Software has announced a contest involving their new game program, Keys of the Castle. Players attempt to survive a series of castles containing ghosts, banshees, skeletons, electric walls, and other hazards. To move from floor to floor, a player must race against a ticking clock and collect 3 magic keys; the keys open three chests containing portions of the magic word needed to advance. Each succeeding castle has a faster clock with less time alloted. Features include on-screen display of score, time, matches, wounds, keys found, magic word, and spells. A unique system of display quickly changes from total floor to single room viewing.

Upon completion of the 6th floor of the 3rd castle, PS Software will award the first skillful adventurer with two TI or third-party game packages of their choice. The second and third persons to complete the adventure game will receive Space Rescue 2.0, a popular program in the firm's growing library of entertainment software. For additional information contact: PS Software P. O. Box 541, Belleville, IL 62222

NEW DIRECT-CONNECT MODEM

Tex-Comp TI-99/4A Users Supply Division of Calvert Enginerring, Inc. has announced the introduction of the new Signalman Mark III Modem designed exclusively for the TI-99/4A. This is the first direct connect, low priced modem that a TI-99/4A owner can purchase and put right to use without having to make extensive and complex modifications. The Mark III was developed by Anchor Automation, Inc. working directly with Texas Instruments and Tex-Comp who tested and evaluated pre-production phototypes. Jerry Price, Vice-President of Tex-Comp, stated that the Signalman Mark III comes complete with all connecting cables and is ready to connect to a TI RS/232 interface or expansion box card for telecommunications. The modem is designed to connect between the receiver and handpiece of a standard Bell modular phone. For phones with dials in the handpiece or non-modular older Bell phones or current General Telephone units, an adapter is available for $15.95. The suggested list price of this new direct connect modem for the TI-99/4A is $139.00. Tex-Comp is offering it at an introductory price of $94.95. For information write, Tex-Comp, P. O. Box 33084, Granada Hills, CA 91344.



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NEW CONCEPT IN HOME COMPUTER SOFTWARE

Republic Software, Inc., has announced that it is now serving the Texas Instruments personal computer community with a series of programs that represent a new concept in personal computer software. Programs in this series execute in Extended BASIC on the 16K TI-99/4 or 99/4A computer, but will operate in machine language if the Expansion RAM is available. Software in this series does not become obsolete as a user expands his or her computer system; instead, it increases its capabilities and speed to match the capabilities of the system on which it is used.

The first software package in this series is Ring Destroyer, a space game that establishes the user as the leader of an expedition spearheading an invasion of Saturn's rings. It features a comprehensive instruction manual that makes it easy for beginners or experienced computer users to play. The Extended BASIC version requires joysticks, but the machine language version permits the use of either the keyboard or joysticks. The game is attractively packaged for retail display.

Ring Destroyer carries a list price of $19.95 for either disk or cassette. For more information contact: Republic Software, Inc., P. O. Box 23042, L'Enfant Plaza, Washington, D.C. 20024, or call (202) 978-3554.

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ASPIC . . . from p. 71

```
3730 CI=A(0)
3740 IF CI=0 THEN 5260
3750 CALL KEY(0,K,ST)
3760 IF (ST<1)+(K<>63)THEN
      3790
3770 I=0
3780 GOTO 730
3790 ON A(2)GOTO 3800,3920
     ,4040,4150,4270,4320,
     4360,4410,4570,4680,4
     720,5100,5130,5160,51
     80,5220,5240,5260
3800 I$=P$(CI,3)
3810 GOSUB 5900
3820 IF F=1 THEN 3870
3830 GOSUB 6050
3840 IF CI>0 THEN 3860
3850 GOTO 3970
3860 IF A(2)=4 THEN 3730
3870 IF T-1>ASC(P$(0,3))TH
     EN 3890
3880 GOTO 5720
3890 T=T-1
3900 L(T)=0.1
3910 GOTO 3730
3920 X$=P$(CI,3)
3930 GOSUB 5770
3940 IF V>=1 THEN 3990
3950 GOSUB 6170
3960 IF CI>0 THEN 3730
3970 I=5
3980 GOTO 730
3990 IF T-1<=ASC(P$(0,3))T
     HEN 5720
4000 T=T-1
4010 L(T)=INT(V)+0.2
4020 L$(T)=CHR$(CI)
4030 GOTO 3730
4040 I$=P$(CI,3)
4050 GOSUB 5900
4060 IF F=0 THEN 4090
4070 GOSUB 6170
4080 IF CI=0 THEN 3970 ELS
     E 3730
4090 IF T-1>ASC(P$(0,3))TH
     EN 4110
4100 GOTO 5720
4110 T=T-1
4120 L$(T)=CHR$(CI)
4130 L(T)=0.3
4140 GOTO 3730
4150 I=7
4160 IF T>60 THEN 730
4170 ON 10*(L(T)-INT(L(T))
     )GOTO 4180,4200,4240
4180 T=T+1
4190 GOTO 3730
4200 L(T)=L(T)-1
4210 IF INT(L(T))=0 THEN 4
     180
4220 CI=ASC(L$(T))
4230 GOTO 3730
4240 I$=P$(ASC(L$(T)),3)
4250 GOSUB 5900
4260 IF F=1 THEN 4180 ELSE
      4220
4270 IF L(T)<>0.1 THEN 397
     0
4280 GOSUB 6170
4290 IF CI=0 THEN 3970
4300 T=T+1
4310 GOTO 3730
4320 X$=P$(CI,4)
4330 GOSUB 5770
4340 L(A(3))=V
4350 GOTO 3730
4360 IF A(3)=0 THEN 4390
4370 CALL COLOR(A(3)+7,A(4
     ),1)
4380 GOTO 3730
4390 CALL SCREEN(A(4))
4400 GOTO 3730
4410 K=4
4420 GOSUB 4450
4430 V=1
4440 GOTO 4580
4450 X$=P$(CI,K)
4460 GOSUB 5770
4470 IF (INT(V)>24)+(INT(V
     )<1)THEN 4550
4480 H=INT(V)
4490 X$=P$(CI,K+1)
4500 GOSUB 5770
4510 IF (INT(V)>32)+(INT(V
     )<1)THEN 4550
4520 S=INT(V)
4530 K=24+8*A(K-1)+56*SGN(
     A(K-1)-1)
4540 GOTO 4560
4550 K=0
4560 RETURN
4570 GOSUB 4610
4580 IF K=0 THEN 5740
4590 CALL HCHAR(H,S,K,INT(
     V))
4600 GOTO 3730
4610 K=5
4620 GOSUB 4450
4630 X$=P$(CI,3)
4640 GOSUB 5770
4650 IF INT(V)>0 THEN 4670
4660 K=0
4670 RETURN
4680 GOSUB 4610
4690 IF K=0 THEN 5740
4700 CALL VCHAR(H,S,K,INT(
     V))
4710 GOTO 3730
4720 CALL CLEAR
4730 CALL COLOR(8,16,16)
4740 FOR I=8 TO 15
4750 CALL HCHAR(I,12,88,8)
4760 NEXT I
4770 A$=""
4780 FOR I=0 TO 63
4790 H=8+INT(I/8)
4800 V=12+I-8*INT(I/8)
4810 CALL HCHAR(H,V,30)
4820 CALL KEY(0,K,S)
4830 IF S<1 THEN 4820
4840 IF K=13 THEN 4940
4850 IF K<>8 THEN 4900
4860 IF I=0 THEN 4820
4870 CALL HCHAR(H,V,88)
4880 I=I-1
4890 GOTO 4790
4900 IF (K<48)+(K>49)THEN
     4820
4910 CALL HCHAR(H,V,88+8*(
     K-48))
4920 A$=SEG$(A$,1,I)&CHR$(
     K-48)
4930 NEXT I
4940 A$=SEG$(A$,1,I)
4950 I$="0123456789ABCDEF"
4960 X$=""
4970 FOR I=1 TO LEN(A$)STE
     P 4
4980 S=8
4990 H=1
5000 W$=SEG$(A$,I,4)
5010 FOR K=1 TO LEN(W$)
5020 H=H+S*ASC(SEG$(W$,K,1
     ))
5030 S=S/2
5040 NEXT K
5050 X$=X$&SEG$(I$,H,1)
5060 NEXT I
5070 CALL CHAR(80+8*A(3),X
     $)
5080 CALL CLEAR
5090 CALL COLOR(8,2,1)
5100 CALL KEY(0,K,S)
5110 L(1)=S*S
5120 GOTO 3730
5130 CALL SOUND(10,30000,30)
5140 CALL SOUND(-600,-5,0)
5150 GOTO 3730
5160 PRINT Q$(A(3))
5170 GOTO 3730
5180 X$=P$(CI,3)
5190 GOSUB 5770
5200 PRINT V
5210 GOTO 3730
5220 INPUT L(A(3))
5230 GOTO 3730
5240 CALL CLEAR
5250 GOTO 3730
5260 I=1
5270 GOTO 730
5280 FOR K=1 TO 5
5290 T=POS(X$,O$(K),1)
5300 IF T>0 THEN 5360
5310 NEXT K
5320 X$=CHR$(0)&"+"&X$
5330 K=1
5340 T=2
5350 IF (T=1)+(T=LEN(X$))T
     HEN 5430
5360 W$=SEG$(X$,1,T-1)
5370 GOSUB 6390
5380 W$=SEG$(X$,T+1,LEN(X$
     ))
5390 X$=CHR$(K)&CHR$(I)
5400 GOSUB 6390
5410 X$=X$&CHR$(I)
5420 RETURN
5430 X$=""
5440 RETURN
5450 FOR H=1 TO 6
5460 ST=POS(A$,R$(H),1)
5470 IF ST>0 THEN 5500
5480 NEXT H
5490 GOTO 5570
5500 X$=SEG$(A$,1,ST-1)
5510 GOSUB 5280
5520 I$=CHR$(H)&X$
5530 X$=SEG$(A$,ST+LEN(R$(
     H)),LEN(A$))
5540 GOSUB 5280
5550 I$=I$&X$
5560 IF LEN(I$)=7 THEN 558
     0
5570 I$=""
5580 RETURN
5590 S=LEN(W$)
5600 IF S=0 THEN 5640
5610 IF POS(W$," ",S)<>S T
     HEN 5640
5620 S=S-1
5630 GOTO 5600
5640 W$=SEG$(W$,1,S)
5650 IF S=0 THEN 5710
5660 S=1
5670 IF POS(W$," ",S)<>S T
     HEN 5700
5680 S=S+1
5690 GOTO 5670
5700 W$=SEG$(W$,S,LEN(W$))
5710 RETURN
5720 I=4
5730 GOTO 5750
5740 I=2
5750 E$(3)=E$(I)&" IN "&ST
     R$(N(P$(CI,1)))
5760 GOTO 730
5770 I=L(ASC(SEG$(X$,2,1))
     )
5780 V=L(ASC(SEG$(X$,3,1))
     )
5790 ON ASC(X$)GOTO 5800,5
     820,5840,5860,5880
5800 V=I+V
5810 RETURN
5820 V=I-V
5830 RETURN
5840 V=I*V
5850 RETURN
5860 V=I/V
5870 RETURN
5880 V=I^V
5890 RETURN
5900 F=0
5910 X$=SEG$(I$,2,3)
5920 GOSUB 5770
5930 J=V
5940 X$=SEG$(I$,5,3)
5950 GOSUB 5770
5960 ON ASC(I$)GOTO 5970,5
     980,5990,6000,6010,60
     20
5970 IF J<=V THEN 6030 ELS
     E 6040
5980 IF J>=V THEN 6030 ELS
     E 6040
5990 IF J<>V THEN 6030 ELS
     E 6040
6000 IF J=V THEN 6030 ELSE
      6040
6010 IF J<V THEN 6030 ELSE
      6040
6020 IF J>V THEN 6030 ELSE
      6040
6030 F=1
6040 RETURN
6050 ST=0
6060 CI=A(0)
6070 IF CI=0 THEN 6160
6080 IF A(2)>5 THEN 6060
6090 IF A(2)>3 THEN 6120
6100 ST=ST+1
6110 GOTO 6060
6120 IF ST=0 THEN 6160
6130 IF A(2)=5 THEN 6060
6140 ST=ST-1
6150 GOTO 6060
6160 RETURN
6170 GOSUB 6050
6180 IF A(2)=4 THEN 6200
6190 CI=0
6200 RETURN
6210 GOSUB 5590
6220 S=POS(W$," ",1)
6230 IF S>0 THEN 6250
6240 S=LEN(W$)+1
6250 W$=SEG$(W$,1,S-1)
6260 RETURN
6270 CI=0
6280 IF A(0)=0 THEN 6320
6290 IF P$(A(0),1)>=J$ THE
     N 6320
6300 CI=A(0)
6310 GOTO 6280
6320 RETURN
6330 FOR I=0 TO ASC(P$(0,5
     ))
6340 IF W$=S$(I,0)THEN 638
     0
6350 NEXT I
6360 S$(I,0)=W$
6370 P$(0,5)=CHR$(I)
6380 RETURN
6390 GOSUB 5590
6400 FOR I=0 TO ASC(P$(0,3
     ))
6410 IF W$=L$(I)THEN 6450
6420 NEXT I
6430 L$(I)=W$
6440 P$(0,3)=CHR$(I)
6450 RETURN
6460 NC=-1
6470 IF LEN(W$)=0 THEN 653
     0
6480 FOR J=1 TO LEN(W$)
6490 IF SEG$(W$,J,1)<"0" T
     HEN 6530
6500 IF SEG$(W$,J,1)>"9" T
     HEN 6530
6510 NEXT J
6520 NC=VAL(W$)
6530 RETURN
```

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TP-I . . . from p. 11

ween the left and right margins. I use this method of setting margins before each page is printed. Use a sufficient number of **BS** (back space) characters to make sure the print head is positioned at column zero.

To set tabs on the machine via the computer, position the print head to the desired point and send a **DC2** character (refer to your User's Guide again). To remove a tab, position the head to the desired spot and send a **DC4** character.

The TP-I that is presently set up on my system doesn't have the tractor feed option. The "single sheet feed" standard configuration is just fine for text editing or word processing work. In fact, I generated this review article using the TP-I.

I think you too will find this new daisy wheel printer from Smith-Corona to be a valuable addition to your TI Home Computer system. The suggested retail price is $895.00. The unit is available now from computer dealers (see ads in this issue). For more information contact a dealer or Smith-Corona Consumer Products Division, 65 Locust Avenue in New Canaan, CT 06840.

Moment . . . from p. 14

CALL CHARPAT – Returns the 16-character pattern of character-code. As an example: CALL CHARPAT(42,C$) sets C$ equal to hexadecimal 000028107C102800, the code for an asterisk.

CALL CHARSET – Restores the standard patterns and colors for characters 32 through 95.

DISPLAY AT – Allows information to be displayed at any part of the screen. Options include: ERASE ALL (see ACCEPT AT), BEEP (see ACCEPT AT), and SIZE which places the number of blank characters to be displayed at the location specified.

IF-THEN-ELSE – Apart from sprites, this is probably the most useful statement with Extended BASIC. Example: IF X = 3 THEN GOSUB 290 ELSE Y = 5. This says, if X equals three then GOSUB line 290. If X does not equal three then make Y equal to five.

Multiple Statement Separator(::) Allows more than one statement to be placed on a single line. Example: CALL CLEAR : : CALL SCREEN(2). This fills the screen with the blank character code then makes the screen black. Besides saving time, this operation saves memory!

PROTECTED clause – When SAVEing a program on disk or tape with the PROTECTED clause, the program can not be listed, edited, or re-SAVEd.

SIZE – Typing out SIZE then pressing ENTER gives the number of BYTES FREE when working on a program. It is quite useful to know how much memory is remaining.

The Wonderful World of Sprites

CALL SPRITE – This creates one or more sprites up to a total of 28. The color, position, direction, and speed of a sprite are given.

CALL COINC – Detects a coincidence between sprites or a sprite and a location. If one sprite "hits" another, then a coincidence is noted.

CALL MAGNIFY – Changes the size of sprites.

CALL PATTERN – Changes the character pattern of a sprite.

CALL MOTION – Sets a sprite in motion at the desired speed and direction.

Other Helpful Tidbits

As I had mentioned earlier, with Extended BASIC it is possible to change the line numbers of statements. I have found this makes it possible to relocate (move) lines in a program.

To be fair, Extended BASIC does have a few undesirable changes.

With Extended BASIC, character code sets 15 and 16 are no longer available. The memory was needed to keep track of sprites.

I have listed only a *few* of the many new functions available with Extended BASIC. But, I feel that what I have listed is more than enough to justify the cost of the module.

Micro Jaws . . . from p. 31

```
100 REM ******************
110 REM *   MICRO JAWS   *
120 REM ******************
130 REM BY SAM PINCUS
140 REM 99'er VERSION 2.1.1XB
150 RANDOMIZE
160 DIM L(9),CV(9),RV(9)
170 GOSUB 270
180 GOSUB 350
190 FOR I=1 TO NF :: IF L(I)=0 THEN
     200 ELSE CALL COINC(#1,#(I+1),
    8,X):: IF X THEN CALL DELSPRITE
    (#(I+1)):: L(I)=0 :: FC=FC-1 ::
     DISPLAY AT(24,1)SIZE(2):FC ::
    IF FC=0 THEN 400
200 NEXT I
210 SV=MIN(MAX(SV,5),15):: RV(0)=0
220 CALL KEY(1,CODE,ST):: RV(0)=2*(
    CODE=5)-2*(CODE=0):: SV=SV+(COD
    E=3)-(CODE=2)
230 CALL POSITION(#1,RO,CO):: IF RO
    <16 THEN RV(0)=2 ELSE IF RO>180
     THEN RV(0)=-2
240 CALL MOTION(#1,RV(0),-SV)
250 IF RND<.3 THEN F=1+INT(RND*NF):
    : IF L(F)=0 THEN 260 ELSE RV(F)
    =RV(F)+RND*RV(0):: CALL MOTION(
    #F+1,RV(F),-CV(F))
260 SEC=SEC-1 :: DISPLAY AT(24,22):
    USING " ###":SEC :: IF SEC THEN
     190 ELSE 400
270 DISPLAY AT(12,10)ERASE ALL:"MIC
    RO JAWS!",,"         BY SAM PINCU
    S"
280 REM
290 CALL CHAR(96,"000000000103FF7F3
    F0F073C000000000000000800106FCFC
    FE8201000000000")
300 CALL SCREEN(6)
310 CALL COLOR(1,4,4)
320 NF=5
330 FOR I=1 TO NF :: CALL CHAR(96+4
    *I,"0000000000000000303010000000
    0000000000000000008F0F088"):: N
    EXT I
340 RETURN
350 FC=NF :: CALL MAGNIFY(3):: SEC=
    149
360 FOR I=0 TO NF :: L(I)=4 :: RV(I
    )=RND*2 :: CV(I)=RND*6+6 :: NEX
    T I :: SV=12
370 DISPLAY AT(23,1)ERASE ALL:"FISH
    ","          TIME",FC,"          ";
    SEC
380 FOR I=0 TO NF :: CALL SPRITE(#(
    I+1),96+4*I,16,16+INT((RND*180)
    /8)*8,24+INT((RND*104)/8)*8,RV(
    I),-CV(I)):: NEXT I
390 RETURN
400 IF FC=0 THEN DISPLAY AT(12,10):
    "A WINNER!!" ELSE CALL DELSPRIT
    E(ALL):: DISPLAY AT(12,10):"YOU
     LOSE!!!"
410 DISPLAY AT(13,1):"WANT TO TRY A
    GAIN ?" :: ACCEPT AT(13,20):A$
    :: IF SEG$(A$,1,1)="Y" THEN 180
     ELSE STOP
```

EXPLANATION OF THE PROGRAM
Micro Jaws

Line Nos.	
190-200	Check each fish to see if Micro Jaws got him.
210	Don't allow Micro Jaws to go too high or too low.
220-240	Check the keyboard and reset Micro Jaws speed and direction.
250	Randomly change a fish's direction to match the same direction Micro Jaws is moving in.
260	Reset fish count and time units.
270-340	Start up. Define sprites, set screen color.
350-390	Set up each fish with random location and row, column velocities.
400-410	End of game.

Dump . . . from p. 48

Listing 1 (cont.)

```
ADDR   LABEL  OPCODE  OPERANDS    COMMENTS
----   -----  ------  --------    --------
              SB      @>837C,@>837C
*                                 CLEAR ERROR BYTE FOR BASIC
              LI      10,50       DELAY
              DEC     10
              JNE     $-2
7EBE          B       *11         RETURN TO BASIC
7EC0   IN     BSS     8           AREA FOR SCREEN PATTERN
7EC8   DO     BSS     8           AREA FOR PRINTER PATTERN
       MK     DATA    >001F       MASK FOR EOL TEST
7ED2   PD     DATA    >0012,>1E00,>FF00,>0000,>001A
*                                 PAB DEFINITION
              TEXT    'RS232.PA=N.DA=8.BA=9600.CR'
*                                 DEVICE NAME
7EF6   CR     DATA    >0D0A       CR LF
7EF8   E1     DATA    >1B4B,>0800
*                                 ESC K GRAPHICS SEQUENCE
7EFC   S1     BSS     2           SAVE AREA
7EFE   E2     DATA    >0D1B,>4108
*                                 CR AND ESC A VERT SPACING
7F02          END
```

Listing 2

BASIC PROGRAM
TO CALL SCREEN DUMP
(SCREEN DUMP RESIDES
IN MINI-MEMORY)

```
100 CALL CLEAR
110 CALL CHAR(96,"183C7EFFFF
    7E3C18")
120 CALL HCHAR(1,1,96,768)
130 CALL KEY(0,RVAL,STAT)
140 IF STAT = 0 THEN 130
150 IF RVAL <> 80 THEN 130
160 CALL LINK("DUMP")
170 END
```

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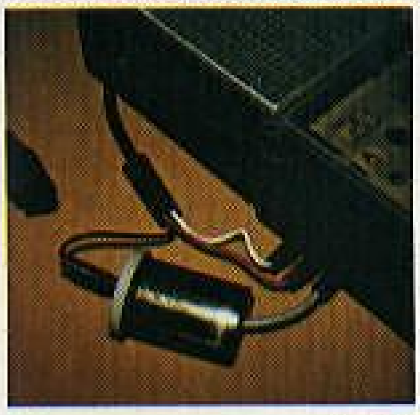

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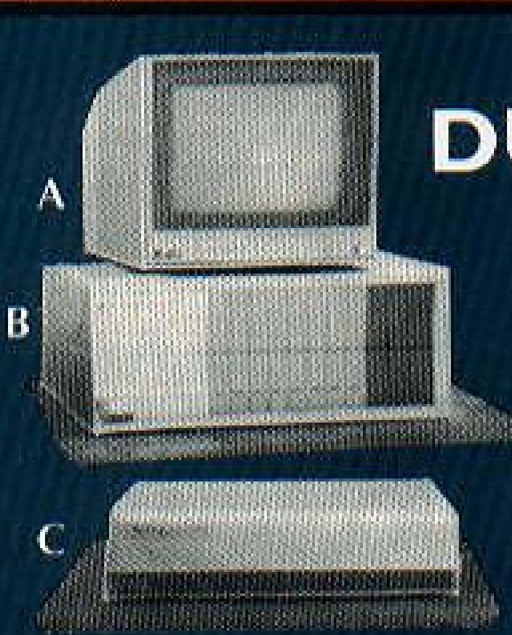

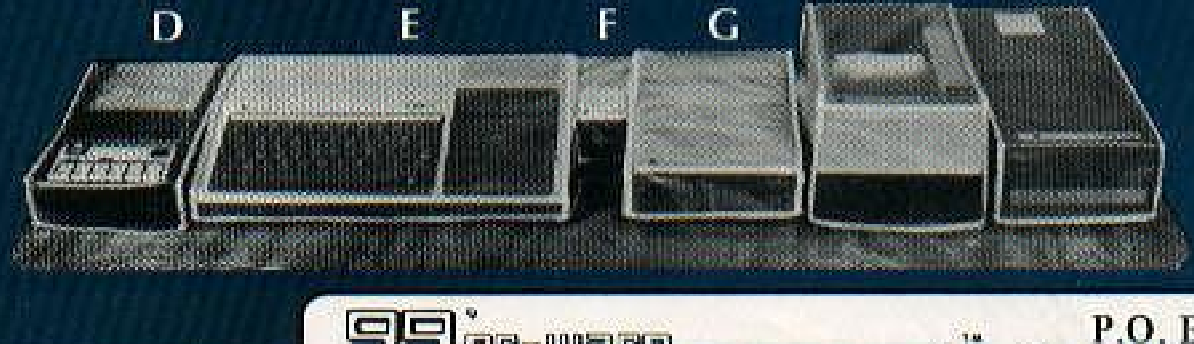

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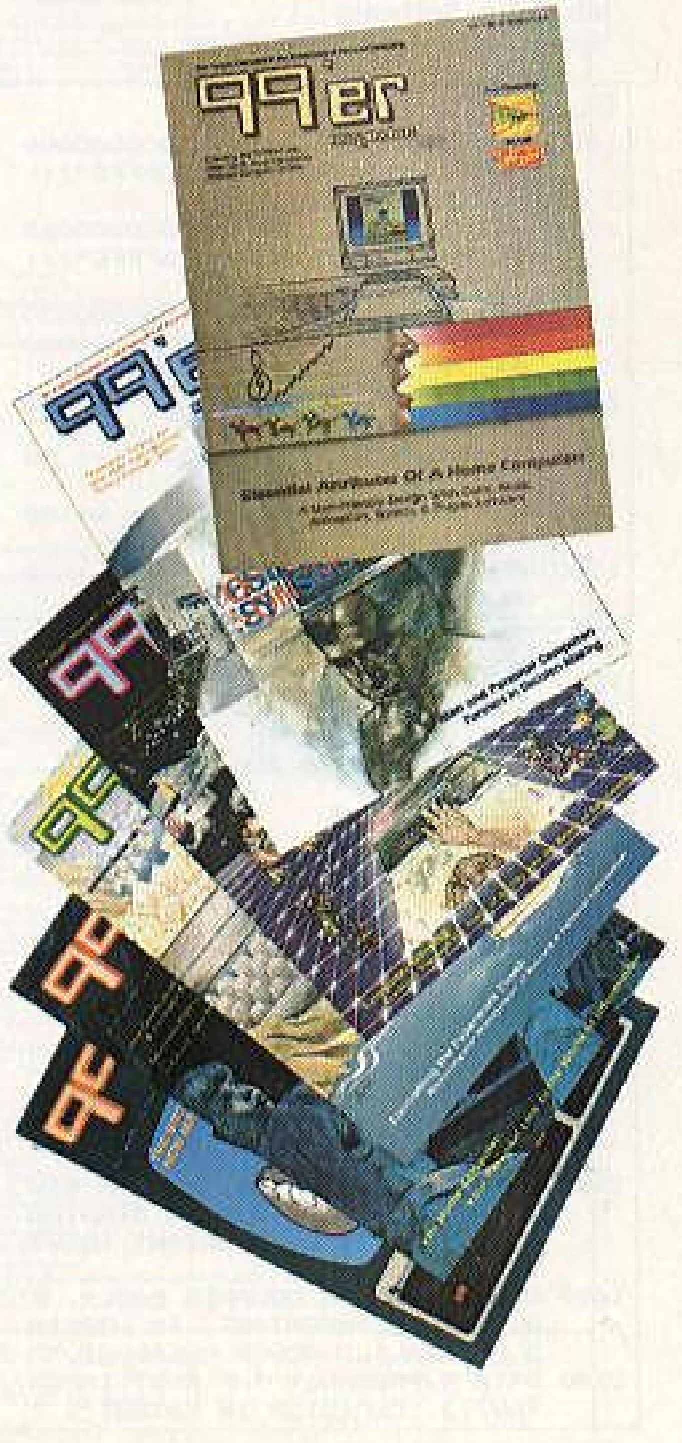

Index to Advertisers

American Software Design & Distributing Co 45
Amnion Stoneware 40
The Bach Company 21, 62
Canadian Micro Works 32
CBM Inc 47
Cintronics 68
CompuTech Distributing, Inc 12, 23
Computer-Ed 71
Corn Software 25
Crawford & Associates 48
Cumberland Technology 61
Data Force Inc 42
Data Systems 37
Denali Data 35
Destiny Computer Services 40
Dhein's True Value 3
John T. Dow 48
Dynamic Data & Devices 57
Eastbench Software Products 60
Easyware 32
Ehninger Associates, Inc 44
Electronic Specialists, Inc 62
Elek-Tek, Inc 79
Epson America, Inc 18
Extended Software Co 38
FFF Software 44
Foundation 67
Futura Software 44
Gembar Graphics 46
Hardin's Computer Solutions, Inc 20
James Harvey 34, 46
Headwind Software 42
Hi-Fi Exchange 38
Intersoft 40
Kaleidoscope Programs 37
Kuhl Software 32
LOGIX 13
Maple Leaf Micro Ware 34, 39
Meca, Inc 61
Michigan Software 35
Microcomputers Corporation 69
Micro-Ed, Inc 52
Millers Graphics 70
Model Masters 32, 39
Murrays 41
Myarc Inc 68
Navarone Industries 60
North Hills Computer 69
Norton Software 39, 70
Not-Polyoptics 29
OakTree Systems 41
Pablo Diablo 61
Pegasus Software 36
Pewterware 45
Prometheus Software 34
PS Software 43
Republic Software 25
RKS Enterprises, Inc 70
Roach Software 37
Scotch Marketing 61
Scott, Foresman 53
Simulsoft 41
Smith-Corona 10
Softcom Enterprises 48
Software Specialists, Inc 36
Denny Sperry 46
Texas Instruments, Inc 8, 54, 80
Texas Instruments, Inc (Lubbock) 63
Tex-Comp 2, 24
Tex-Soft Software 43
Textiger 61
The TI-99/4 Program Exchange 41
Tomputer Software 35
Triple H Furniture 41
TNT Computer Products 26
TSS 36
Unisource Electronics, Inc 58
Wentworth Supplies 36
YCAN Systems, Inc 71
99'er Bookstore ....Front Order Card
99'er Magazine ....Front Order Card
99'er-ware 76, 77

Up Scope . . . from p. 37

```
1490 CALL CHAR(132,X$&"000000000000
     FF7F"&X$&"00000000287CFFFE")::
      RETURN ! TANKER
1500 CALL CHAR(132,X$&"000000000065
     FF75"&X$&"00000040C0E6FFFE")::
      RETURN ! BATTLESHIIP
1510 CALL CHAR(132,X$&"001000000800
     FF7F00000000000040000000000000
     38FFFE"):: RETURN ! CARRIER
1520 CALL SOUND(1000,1000,30):: RET
     URN
1530 R$="DESTROYER" :: W=2100 :: GO
     SUB 1450 :: RETURN
1540 R$="DESTROYER ESCORT" :: W=140
     0 :: GOSUB 1460 :: RETURN
1550 R$="TORPEDO BOAT" :: W=75 :: G
     OSUB 1470 :: RETURN
1560 CALL KEY(0,K,S):: IF S<>1 THEN
      1560 ELSE K2=POS(MASK$,CHR$(K
     ),1):: IF K2=0 THEN 1560 ELSE
     RETURN
1570 CALL SCREEN(4):: DISPLAY AT(4,
     9)ERASE ALL:"UP SCOPE! " :: RE
     TURN
1580 DISPLAY AT(6,9):"BEST GAMES" :
     : FOR X=1 TO 5
1590 DISPLAY AT(X+6,2):"USS " :: DI
     SPLAY AT(X+6,6):BEST$(X)
1600 DISPLAY AT(X+6,17):B(X);" TONS
     " :: NEXT X :: RETURN
1610 SUB SONAR
1620 CALL SOUND(100,440,0):: FOR X=
     3 TO 1 STEP -1 :: CALL SOUND(X
     ,440,14):: NEXT X :: SUBEND
1630 SUB SHIP :: IF RND>.6 THEN RS=
     -2 ELSE RS=-1
1640 CALL SPRITE(#9,132,13,17,129,0
     ,RS):: SUBEND
1650 SUB FIREDISP(A):: IF A=0 THEN
     1660 ELSE X$="FIRED" :: Y$=STR
     $(A):: GOTO 1670
1660 X$,Y$=""
1670 DISPLAY AT(6,3)SIZE(5):X$ :: D
     ISPLAY AT(8,5)SIZE(2):Y$ :: SU
     BEND
1680 SUB SURFACE
1690 FOR Y=96 TO 99 :: FOR X=1 TO 1
     6 :: CALL CHAR(Y,RPT$("F",X)):
     : NEXT X :: NEXT Y :: SUBEND
1700 SUB SUBMERGE :: FOR X=96 TO 99
      :: CALL CHAR(X,"0"):: NEXT X
     :: SUBEND
```

Knights . . . from p. 34

```
1530 RETURN
1540 CALL CLEAR
1550 CALL SCREEN(8)
1560 FOR DELAY=1 TO 300
1570 NEXT DELAY
1580 RETURN
1590 RESTORE 1670
1600 GOSUB 1540
1610 FOR Y=1 TO 22
1620 GOSUB 1450
1630 NEXT Y
1640 IS=1
1650 GOSUB 1220
1660 ON KEY GOTO 1730,470,2080
1670 DATA 7,** KNIGHT'S TOUR **,1,"
     ",1,"",1,"",4,I HOPE YOU ENJOY
     ED KNIGHT'S,2,TOUR? NOW THAT Y
     OU'RE TOTALLY
1680 DATA 2,"FRUSTRATED,  I CAN GIV
     E YOU A",2,FEW TIPS ON STRATEG
     Y.,1,"",4,IT'S IMPORTANT TO VI
     SIT THE
1690 DATA 2,CORNER SQUARES EARLY. E
     QUALLY,2,"IMPORTANT, IS LOOKIN
     G SEVERAL",2,MOVES AHEAD.,1,""
1700 DATA 4,PROBABLY THE MOST IMPOR
     TANT,2,"DECISION IN KNIGHT'S T
     OUR, IS",2,SELECTING THE START
     ING POINT.
1710 DATA 1,"",1,"",5,TYPE 1 TO SEE
      SOLUTION,5,TYPE 2 TO PLAY AGA
     IN,5,TYPE 3 TO QUIT
1720 REM   PERFECT GAME:
1730 GOSUB 1030
1740 RESTORE 2020
1750 M=0
1760 FOR M2=3 TO 12 STEP 3
1770 FOR M1=3 TO 18
1780 M=M+1
1790 V1=V
1800 READ KEY
1810 GOSUB 1330
1820 H1=H
1830 READ KEY
1840 GOSUB 1400
1850 IF M1>3 THEN 1890
1860 IF M2>3 THEN 1890
1870 GOSUB 980
1880 GOTO 1900
1890 GOSUB 910
1900 M$=STR$(M)
1910 X=28
1920 Y=1
1930 GOSUB 1460
1940 FOR DELAY=1 TO 800
1950 NEXT DELAY
1960 NEXT M1
1970 NEXT M2
1980 GOSUB 1440
1990 GOSUB 1440
2000 GOSUB 1220
2010 ON KEY GOTO 470,2080,2080
2020 DATA 49,65,51,66,49,67,50,65,5
     2,66,54,65,56,66,55,68,56,70,5
     5,72,53,71,51,72
2030 DATA 49,71,50,69,51,71,49,72,5
     0,70,49,68,50,66,52,65,54,66,5
     6,65,55,67,56,69
2040 DATA 55,71,53,72,54,70,56,71,5
     4,72,55,70,56,72,54,71,52,72,5
     0,71,49,69,50,67
2050 DATA 51,65,49,66,50,68,49,70,5
     0,72,51,70,52,68,53,66,55,65,5
     6,67,55,69,54,67
2060 DATA 53,65,55,66,56,68,54,69,5
     2,70,51,68,53,67,52,69,51,67,5
     3,68,51,69,52,71
2070 DATA 53,69,52,67,54,68,53,70,2
     2,6,TYPE 1 TO PLAY AGAIN,23,6,
     TYPE 2 TO QUIT
2080 CALL CLEAR
2090 END
```

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